

**ESSAYS ON PUBLIC HEALTH IN DEVELOPING
COUNTRIES**

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ABSTRACT

Reproductive health is a crucial part of general health and a central feature of human development. Since gaining global attention at the 1994 International Conference on Population and Development (ICPD), the importance of reproductive was reaffirmed as one of the eight goals of Millennium Development Goals (MDGs), and in the post-2015 development agenda. This thesis addresses the key issues of public health affecting childbearing women and the older people. Universal access to reproductive health, reducing maternal deaths and non-communicable diseases (NCDs) are among the main targets of the new agenda for the global Sustainable Development Goals (SDGs) 2015-2030. The objectives of the thesis are:

1. To investigate problems relating to reproductive health and NCDs,
2. To examine the correlates and risk factors of reproductive health outcomes and NCDs that are of public health concerns,
3. To evaluate the barriers to the utilization of health services in the developing countries, and
4. To put forth recommendations for policy and research.

The objectives are partially achieved through the writing of five essays listed below. A comprehensive review of the literature was carried out to complete the thesis.

1. Proximate Determinants of Fertility in Peninsular Malaysia
2. Medical Students' Attitudes toward Abortion Education: Malaysian Perspectives
3. Correlates of and Barriers to the Utilization of Health Services for Delivery in South Asia and sub-Saharan Africa
4. Ethnic and Gender Differentials in Non-communicable Diseases and Self-rated Health in Malaysia
5. The Debilitating Effects of Chronic Diseases among the Oldest Old in China

An analysis of the proximate determinants of fertility indicate that marriage postponement and contraceptive use are the two most important factors affecting fertility, but breastfeeding and abortion also play a role in fertility reduction. Abortion is a serious public health issue, and it poses high risks to the health and life of women. A survey on medical students in Malaysia showed that 9 out of 10 students wanted more training on the general knowledge and legal aspects of abortion, and pre- and post-abortion counseling. Hence, there is a need to incorporate abortion education in the curriculum of medical schools. Unmet need for contraception remains at a high level in some developing countries. The reproductive health needs of couples and adolescents need to be given more attention. The national family planning program needs to be revitalized to provide services beyond family planning such as infertility treatment and bio-medical research. A family policy is also needed to foster family development and to advocate for family friendly work environment for work-life balance. Chronic diseases are rising rapidly, affecting people of all ages, especially the older people. Preventive, protective and rehabilitative measures must be taken to reduce these diseases. The root cause of the chronic diseases, including modifiable factors such as unhealthy life style and diet must be addressed. There exists wide gaps in the utilization of health services. Efforts must be made to overcome supply-side and demand-side barriers. The thesis concludes by putting forth some recommendations for policy and future research.

ABSTRAK

Kesihatan reproduktif adalah komponen yang penting dalam kesihatan umum dan ciri utama dalam pembangunan insan. Sejak menerima perhatian sedunia di Persidangan Antarabangsa mengenai Kependudukan dan Pembangunan pada tahun 1994, kepentingan kesihatan reproduktif disahkan semula sebagai salah satu daripada lapan matlamat Matlamat Pembangunan Alaf (2000-2015), dan dalam agenda pembangunan pasca-2015. Tesis ini meliputi isu-isu utama kesihatan awam yang menjejaskan wanita yang melahirkan anak dan warga tua. Akses sejagat kepada kesihatan reproduktif, mengurangkan kematian ibu bersalin dan penyakit tidak berjangkit adalah antara sasaran utama agenda baru untuk Matlamat Pembangunan Lestari Sedunia (2015-2030). Objektif tesis ini adalah:

1. Menyiaskan masalah berkaitan dengan kesihatan reproduktif dan penyakit tidak berjangkit,
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3. Menilai halangan kepada penggunaan perkhidmatan kesihatan di negara membangun, dan
4. Mengemukakan cadangan bagi dasar dan penyelidikan.

Objektif tesis ini sebahagiannya dicapai melalui penulisan lima esei seperti yang disenaraikan di bawah. Selain itu, sorotan literatur secara menyeluruh dilakukan untuk melengkapkan tesis ini.

1. Penentu Langsung Fertiliti di Semenanjung Malaysia
2. Sikap Pelajar Perubatan terhadap Pendidikan Pengguguran: Perspektif Malaysia
3. Faktor dan Hubung Kait dengan dan Halangan kepada Penggunaan Perkhidmatan Kesihatan untuk Bersalin di Asia Selatan dan sub-Sahara Afrika

4. Perbezaan Etnik dan Jantina dalam Penyakit Tidak Berjangkit dan Persepsi Kesihatan Diri di Malaysia

5. Kesan Teruk Penyakit Kronik ke atas Warga Tertua di China

Analisis penentu langsung fertiliti menunjukkan bahawa kahwin lewat dan penggunaan kontraseptif adalah 2 faktor yang paling penting dalam mempengaruhi fertiliti, tetapi penyusuan anak dan pengguguran juga memainkan peranan dalam pengurangan fertiliti. Pengguguran adalah isu kesihatan awam yang serius, dan ia menimbulkan risiko tinggi kepada kesihatan dan kesejahteraan wanita. Satu kajian ke atas pelajar perubatan di Malaysia menunjukkan bahawa 9 daripada 10 pelajar ingin mendapat lebih latihan mengenai pengetahuan am dan aspek undang-undang terhadap pengguguran, dan kaunseling sebelum dan selepas pengguguran. Oleh itu, terdapat keperluan untuk menggabungkan pendidikan pengguguran dalam kurikulum sekolah perubatan. Keperluan penggunaan kaedah kontraseptif yang tidak dipenuhi kekal pada tahap yang tinggi. Keperluan kesihatan reproduktif di kalangan pasangan dan remaja perlu diberi lebih perhatian. Program perancangan keluarga kebangsaan perlu digiatkan semula untuk menyediakan perkhidmatan lain seperti rawatan kemandulan dan penyelidikan bio-perubatan. Dasar keluarga juga diperlukan untuk memupuk pembangunan keluarga dan untuk menyokong persekitaran kerja yang mesra keluarga untuk keseimbangan kerja dan kehidupan keluarga. Penyakit kronik yang semakin meningkat dengan pesat telah menjejaskan rakyat semua peringkat umur, terutama warga tua. Langkah pencegahan, perlindungan dan pemulihan diperlukan untuk mengurangkan penyakit ini. Punca penyakit kronik, faktor-faktor penyebab yang boleh diubahsuai seperti gaya hidup yang tidak sihat dan diet perlu ditangani. Memandangkan jurang yang luas dalam penggunaan perkhidmatan kesihatan, usaha perlu diambil untuk mengatasi faktor yang menghalang dari segi penawaran dan permintaan. Tesis ini diakhiri dengan memberi beberapa cadangan bagi dasar dan kajian masa depan.

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LIST OF SYMBOLS AND ABBREVIATIONS

Abbreviations

ADL	Activities of Daily Living
BADL	Basic Activities of Daily Living
BMI	Body Mass Index
CHD	Coronary Heart Disease
CKD	Chronic Kidney Disease
CLHLS	China Longitudinal Health and Longevity Survey
CPR	Contraceptive Prevalence Rate
DALYS	Disability-Adjusted Life-Years
DHS	Demographic and Health Surveys
HBP	High Blood Pressure
IADL	Instrumental Activities of Daily Living
ICPD	International Conference on Population and Development
ICT	Information and Communications Technology
IPUMS	Integrated Public Use Microdata Series
IUD	Intrauterine Device
KAP	Knowledge, Attitudes, and Practices
MDGs	Millennium Development Goals
MMR	Maternal Mortality Ratio
NCDs	Non-communicable diseases
NPFDB	Malaysia National Population and Family Development Board
ob-gyn	Obstetrics and Gynecology
PoA	Programme of Action
SBA	skilled birth attendant
SBAs	Skilled Birth Attendants
SDGs	Sustainable Development Goals
TBAs	Traditional Birth Attendants
TF	Total Fecundity Rate
TFR	Total Fertility Rate
UN	United Nations
UNFPA	United Nations Population Fund
WHO	World Health Organization

CHAPTER 1: INTRODUCTION

1.1 Prioritizing Reproductive Health

According to the United Nations (UN), “reproductive health is a crucial part of general health and a central feature of human development. It is a reflection of health during childhood, and crucial during adolescence and adulthood, sets the stage for health beyond the reproductive years for both women and men, and affects the health of the next generation” (UN, 1994, 2014). Reproductive health gained global attention with the adoption of a 20-year Programme of Action (PoA) at the 1994 International Conference on Population and Development (ICPD). The PoA devoted one chapter on reproductive health to put forth the basis for actions and suggested a host of actions to achieve six clearly stated objectives, one of which is to “help couples and individuals meet their reproductive goals in a framework that promotes optimum health, responsibility and family well-being, and respects the dignity of all persons and their right to choose the number, spacing and timing of the birth of their children” (UN, 1994, 2014).

The 1994 ICPD PoA was adopted at a time when the world had changed in ways that created important new opportunities for addressing population and development issues. Notably, there had been major shifts in attitude with regard to reproductive health, family planning and population growth, resulting, inter alia, in the new comprehensive concept of reproductive health, including family planning and sexual health. The PoA provided a framework for the formulation and implementation of policies and programs affecting population and development. These policies and programs called for a new strategy that emphasized on the linkages between population and development to meet the needs of individuals rather than on achieving demographic targets (UN, 1994). Actions to be taken

by individual countries included making accessible through the primary health care system a full range of reproductive health services, including family planning, education and services for prenatal care, safe delivery and post-natal care; prevention and appropriate treatment of infertility; prevention of abortion and management of the consequences of abortion; treatment of reproductive tract infections; sexually transmitted diseases and other reproductive health conditions. Reproductive health, as defined in the PoA and adopted by World Health Organization (WHO), is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, in all matters relating to the reproductive system and to its functions and processes. Hence, reproductive health extends beyond the traditional maternal and child health to cover family planning, adolescent sexuality and reproductive health, induced abortion, sexually transmitted infection (including HIV/AIDS), domestic/gender violence, infertility, male responsibility and participation, and education and counseling (United Nations, 1994).

At the UN Millennium Summit in 2000, the world leaders reaffirmed their commitments to achieve universal access to reproductive health, as set out in the Millennium Development Goals (MDGs) targets under MDG 5, with specific targets to reduce maternal mortality ratio (MMR) by three quarters between 1990 and 2015, through achieving universal access to reproductive health, including family planning. These MDGs targets reinforce the centrality of reproductive health and reproductive rights in improving maternal and infant health. Improving maternal health is also a key to achieving MDG 4 of reducing child mortality.

As the MDGs came to a close, world leaders adopted a new post-2015 development agenda – a global plan of action, consisting 17 Sustainable Development Goals (SDGs) and 169 targets for the period 2015-2030, to build on the MDGs and complete what these did not achieve. Under the new agenda, the UN, WHO and all partner organizations recommit to the full realization of all the MDGs, including Goal 5 on maternal health to ensure universal access to sexual and reproductive health care services, including family planning, information and education. SDG Goal 3 is to ensure healthy lives and promote well-being for all ages, underpinned by 13 targets. Almost all of the other 16 SDGs impact or are impacted by health.

Target 3.1 of SDG is aimed at reducing maternal mortality, and both targets 3.7 and 5.7 are to ensure universal access to sexual and reproductive health services, which fell short of the MDGs. The rapid rise of non-communicable diseases (NCDs) and the devastating impact of these diseases was duly recognized and hence target 3.4 is aimed at reducing these diseases.

1.2 The State of Reproductive Health and Non-communicable Diseases (NCDs)

1.2.1 Reproductive Health

The demographic, social, economic, technological, environmental and geo-political changes that began in the 20th century have continued into the new millennium. Many developing countries have followed the pathways of the developed countries in the demographic transition within a much shorter period. This was made possible by the rising standard of living, improvement in health infrastructures and better access to reproductive health services, including family planning. However, the least developed

countries, mostly in Africa are still grappling with the problems posed by high fertility and high rate of population growth.

Of the MDG targets, maternal health target was one of the most off-track. Hence, there is a need to step up efforts with stronger political will and backing. Between 1990 and 2013, maternal mortality ratio declined by 45 percent globally. Despite this progress, every day about 800 women die during pregnancy or from childbirth-related complications. In the countdown to 2015, the 75 percent reduction in maternal health is still widely off-track, and the target of achieving universal access to reproductive health is also experiencing slow progress in the low-resource setting (Tsui, 2012; UN, 2015b). MMR remained more than twice as high as the target of 95 maternal deaths per 100,000 births. Studies show that antenatal visits and delivery by a skilled birth attendant (SBA) are important in reducing the burden of maternal morbidity and mortality (Mpembeni et al., 2007; Islam, Islam & Yoshimura, 2014; Worku, Yalew & Afework, 2014; Wilunda et al., 2015). The target of universal access to reproductive health was also off-track as one in four babies worldwide was delivered without skilled care. Moreover, wide disparity in the utilization of health services exists at the various levels. The 2015 MDGs Report highlighted a 31 percentage-point gap between urban and rural areas in the coverage of births attended by skilled health personnel (UN, 2015a).

Notwithstanding the rise of contraceptive prevalence rate (CPR) from 55 percent in 1990 to 64 percent in 2015 globally, 216 million women (or 12 percent of the married women in the reproductive age) worldwide had an unmet need for modern methods of contraception (UN, 2015a). Contraceptive use varies widely across and within region. CPR remains relatively low in sub-Saharan Africa, at about 28 percent, in contrast to more than 70 percent in Latin America and the Caribbean, and more than 80 percent in

East Asia. Some 140 million married women, mostly in developing countries would like to delay or avoid pregnancy, but do not have access to family planning services. About one in four women in sub-Saharan Africa have unmet need for contraception, and this is about twice as high as other developing regions, and six times higher than East Asia. The high unmet need contributes to increasing numbers of unwanted pregnancies, unsafe abortions and maternal deaths.

Unmet need for contraception contributed to 82 percent of unintended pregnancies in developing countries (Sedgh et al., 2012). Unwanted pregnancies in turn resulted in unsafe abortion. WHO defines unsafe abortion as a procedure for terminating a pregnancy that is performed by an individual lacking the necessary skills, or in an environment that does not conform to minimal medical standards, or both. The restrictive law in some countries is among one of the many barriers to access to abortion, which compels women to turn to unsafe abortion (Department of Reproductive Health and Research, 2011). Unsafe abortion is a serious public health issue in developing countries. Instead of preventing abortion, the restrictive laws make it clandestine and unsafe (Sedgh et al., 2012).

The abortion rate remained flat at around 28 per thousand women in the reproductive age between 2003 and 2008. Of the estimated 38 million abortions in the developing countries, 56 percent were unsafe. In Asia, the proportion of unsafe abortion varies from virtually none in East Asia to 65 percent in South Central Asia. Nearly all (95-97 percent) abortions in Africa and Latin America were unsafe. Some 47,000 women died of unsafe abortions in 2008, making up 13 percent of all maternal deaths worldwide (Sedgh et al., 2012).

Wide disparities in maternal mortality and inequalities in access to and use of reproductive health services persist within and across regions. Most of the maternal deaths are concentrated in sub-Saharan Africa and Southern Asia, which together accounted for 86 percent of such deaths globally in 2013. WHO estimated a life time risk of a maternal death of 1 in 16 in sub-Saharan Africa while it was only 1 in 2,800 in developed countries (Mpembeni et al., 2007). Only half of pregnant women in developing regions receive the recommended minimum of four antenatal care visits, and 48 percent of the births in sub-Saharan Africa and Southern Asia of the births were not attended by trained personnel, compared to 90 percent in North America, Latin America and the Caribbean, and 100 percent in East Asia.

1.2.2 Non-communicable Diseases (NCDs) – The Major Cause of Disability and Mortality

The Framework of Actions for the follow-up to the Programme of Action of the International Conference on Population and Development noted that “the global health burden shifted towards non-communicable diseases and injuries, while communicable, maternal, nutritional and neonatal conditions persisted in developing countries” (UN, 2014). According to WHO, “NCDs are one of the major health and development challenges of the 21st century. NCDs cause human suffering and harm the socio-economic fabric of countries, particularly in developing countries” (WHO, 2014). The prevalence rate of NCDs such as chronic kidney disease in the developing countries is much higher than that of the developed countries (Perkovic et al., 2008). The prevalence of chronic diseases the developing countries is expected to increase along with rising hypertension and diabetes (Ito et al., 2008).

In 2012, out of the 56 million deaths worldwide, 38 million were caused by NCDs, and this is projected to increase to 52 million by 2030, on account of population growth and improved longevity. Nearly three quarters of these NCD deaths (28 million), and 82 percent of premature NCD deaths occurred in low- and middle-income countries. WHO figures show that about 40 percent of the mostly preventable NCD deaths were premature, affecting people under 70 years of age, and this proportion is higher in the developing countries, at 48 percent.

Four major NCDs accounted for 82 percent of NCD deaths. In 2012, cardiovascular diseases were responsible for 17.5 million deaths or 46.2 percent of NCD deaths, followed by cancers (8.2 million, or 21.7 percent of NCD deaths), respiratory diseases, including asthma and chronic obstructive pulmonary disease (4 million, or 10.7 percent of NCD deaths) and diabetes (1.5 million, or 4 percent of NCD deaths). Annual cardiovascular disease mortality is projected to increase from 17.5 million in 2012 to 22.2 million in 2030, and annual cancer deaths from 8.2 million to 12.6 million during the same period.

Understanding the risk factors in NCDs is an important step in the prevention and control of these diseases. The rise in NCDs is closely linked with unhealthy life style, such as harmful use of alcohol and tobacco, excess salt/sodium intake and physical inactivity. In 2012, an estimated 3.3 million deaths, or 5.9 percent of all deaths worldwide, were attributable to alcohol consumption, and more than half of these deaths resulted from NCDs. Tobacco use remains the cause of 6 million preventable deaths per year globally. The global mean intake of salt, estimated at around 10 g daily is twice the level that would lead to raised blood pressure and increases the risk of heart disease and stroke. In 2010, 20 percent of adult men and 27 percent of adult women did not meet WHO recommendations on physical activities (at least 150 minutes of moderate intensity

physical activity per week) to reduce the risk of cardiovascular disease, diabetes, cancer and all-cause mortality. High blood pressure (HBP) is one of the leading risk factors for mortality (causing 9 million deaths) and disability (contributing to 7 percent of disease burden). In 2014, HBP affected 22 percent of adults aged 18 years and over. The global prevalence of diabetes, a major cause of NCDs, was estimated to be 9 percent in 2014. Worldwide, obesity has more than doubled since 1980, and in 2014, 11 percent of men and 15 percent of women aged 18 years and older were obese. Chronic diseases are closely associated with socio-economic factors. Rural residents and the disadvantaged groups tend to have higher prevalence of NCDs (Hoang et al., 2007).

Co-morbidity is increasingly prevalent around the world (Hung et al., 2011; Arokiasamy, Uttamacharya & Jain, 2013). In China, between 48 percent and 86 percent of older persons who had one NCD also had at least one other sickness (Tey, Lai & Teh, 2016). Diabetes causes premature death and increases the risk of heart disease, kidney failure, blindness and lower-limb amputation (WHO, 2014). A multi-country study found that stroke is strongly associated with dementia (Sousa et al., 2009).

As the major cause of deaths, cardiovascular diseases, cancers and astro-intestinal diseases are responsible for about 38 percent of the global burden of disability in terms of disability-adjusted life-years (DALYs). An estimated 5 percent of the DALYs is attributed to alcohol consumption. Musculoskeletal, cardiovascular disease and neurological disorder contributed most to the burden of disability, and of these diseases, back pain, peripheral vascular disease and stroke have very high disabling impact, especially among the oldest old. Other diseases which are less disabling, such as arthritis and heart disease, contributed substantially to the burden of disability because of their high prevalence (Sousa et al., 2009; Klijs et al., 2011; Palazzo et al., 2012). In many parts

of the world, dementia contributed most to the burden of disability (Sousa et al., 2009). A better knowledge of the diseases that contribute to the disability burden will provide the necessary guides to reduce the burden of disability and to maintain the quality of life. The growing number of older people who are afflicted with NCD is straining the health care and social protection systems of the less developed and low income countries. At the family level, older people who are disabled by NCD require more intensive care and support. However, family support is diminishing with fertility decline.

The Global NCD Action Plan, including nine global targets and a global monitoring were adopted by the World Health Assembly in 2013. This action plan has specific targets for reducing each of the NCDs, by tackling the contributory factors. The global target is to have a 25 percent relative reduction in overall mortality from cardiovascular diseases, cancer, diabetes or chronic respiratory diseases. The key barriers to attaining this target include the lack of a well-functioning civil/vital registration system for monitoring, weak health system infrastructure and inadequate funding for prevention and control of NCDs.

1.3 Research Objectives

The main objective of this thesis is to study aspects of reproductive health and NCDs which are the priority areas of the post-2015 SDGs. The specific objectives of this thesis are:

1. To investigate problems relating to reproductive health and NCDs,
 2. To examine the correlates and risk factors of reproductive health outcomes and NCDs that are of public health concerns,
 3. To evaluate the barriers to the utilization of health services in the developing countries,
- and

4. To put forth recommendations for policy and research.

To achieve these objectives, this thesis presents the findings from five published articles – three on reproductive health and two on NCDs, supplemented by salient findings from an extensive literature review. While the focus of this thesis is on the developing countries where health problems are more pressing, relevant findings from the developed countries are cited in the literature review.

The five published articles are as follows:

1. Proximate Determinants of Fertility in Peninsular Malaysia
2. Medical Students' Attitudes toward Abortion Education: Malaysian Perspectives
3. Correlates of and Barriers to the Utilization of Health Services for Delivery in South Asia and sub-Saharan Africa
4. Ethnic and Gender Differentials in Non-communicable Diseases and Self-rated Health in Malaysia
5. The Debilitating Effects of Chronic Diseases among the Oldest Old in China

1.4 Health Issues Affecting Women and Older People

There is a growing interest in public health research to conceptualize disease aetiology within a life course framework in studying the long-term effects on chronic disease risk of physical and social exposures during gestation, childhood, adolescence, young adulthood and later life (Ben-Shlomo & Kuh, 2002). Studies using the life course health development framework show that health is a consequence of multiple determinants operating in nested generic, biological, behavioral, social and economic contexts that change as a person develops (Halfon & Hochstein, 2002; Shoham, Vupputuri & Kshirsagar, 2005; Stein, Thompson & Waters, 2005; Batty et al., 2007; Shibusawa & Padgett, 2009; Crowther, 2012; Angkurawaranon et al., 2015).

The five essays in this thesis are in line with the conceptual framework of the life course health development, and the scope of reproductive health, encompassing the health of both gender from "womb to tomb".

The first three articles cover reproductive health affecting women in childbearing ages, and they come under Goal 5 of MDGs and targets 3.1, 3.7 and 5.7 of Goal 3 of SDGs. Reproductive health is an integral part of primary health care and it is the responsibility of the government. The remaining two articles focus on the another target groups under target 3.4 of SDGs Goal 3, and most of these are older adults who are much more likely to be afflicted by NCDs, with severe disabling impact.

Research on fertility remains highly relevant. Demographic transition has brought about profound changes in social structure, accompanied by epidemiological changes. Fertility has declined to a low level in many developing countries, but it has remained at

a high level in sub-Saharan Africa. Countries with ultra low fertility are finding ways to increase it, while those with high fertility are struggling to bring it down. For effective policy intervention, there is a need to understand the changing roles of each of the proximate determinants.

In Malaysia, the continuing fertility decline despite the stagnation of contraceptive use at about 53 percent (or about 33 percent for modern methods) since the mid-1980s has triggered considerable interest in the reasons behind this phenomenon, such as increase in abortion, sterility, and out-of-wedlock pregnancy. The first article on “Proximate Determinants of Fertility in Peninsular Malaysia” in this thesis was an attempt to provide some answers to this paradox. The census and survey data were used to fit in Bongaarts' framework on proximate determinants of fertility to estimate the fertility inhibiting effects of marriage postponement, contraception and breastfeeding, and to derive the abortion ratio, as a residual. Results show that marriage postponement and contraceptive use are the two most important proximate determinants of fertility for all the three main ethnic groups, although the effects are not uniform. The predicted total fertility rate (TFR) for Chinese and Malays are 2.9 and 1.6, respectively, compared with the observed level of 3.0 and 1.9. Postpartum infecundability and abortion also play a part in explaining ethnic fertility differentials. The estimated abortion ratio of 14 per thousand live births from the model probably represents an under estimate of the true level, as this appears too low as compared to the average of 28 for Southeast Asia (Department of Reproductive Health and Research, 2011). The increase in unsafe abortion is partly due to the unmet need for contraception. Hence, in striving to achieve the target of universal access to reproductive health service, there is a need to improve family planning services and remove the barriers to contraceptive use. The importance of contraceptive use is reaffirmed in the SDGs as

parts of the health and women's rights targets. Research interest on contraceptive use is reflected in the proliferation of publication on this topic, as presented in Chapter 2.

Although reliable data on abortion is not available in Malaysia, there are indications that it is on the rise, as reported in the media. Increase in abortion has contributed to the rapid fertility decline to replacement level for the total population, and to ultra low level of below 1.5 among Chinese and Indian Malaysians. In many settings, restrictive abortion policy and the lack of skilled health personnel have compelled women in need of such services to go to untrained provider and undergo unsafe abortion. The second article on “Medical Students’ Attitudes toward Abortion Education: Malaysian Perspectives” is based on survey on the knowledge and perception of medical students on abortion, as well as their desire for abortion training and willingness to provide abortion services in their future practice. Results from the survey show that medical students in Malaysian universities are slightly more pro-choice than pro-life, and most have expressed an interest to learn more about abortion, including counseling services.

The MDGs report 2015 shows that the target of universal access to reproductive health is far from being achieved in some developing counties, as majority of births were not attended by a skilled health personnel. The third article on utilization of health services focuses in South Asia and sub-Saharan Africa where MMR remain at a high level. The high proportion of the births outside a health facility has contributed to the high MMR in these countries. In all the six countries in this study, women who were less educated and coming from poorer families, and from the rural areas had higher unmet need for maternal care services. Inaccessibility and family objections posed as barriers to the utilization of services. Traditional birth attendants (TBAs) played an important role in delivery, and they should be integrated into the health system. Increasing the health care utilization will

require a holistic approach including upgrading the educational attainment, involving the media and family as well as investing more on health to improve access to the health services.

The declining fertility has resulted in the population ageing in many developing countries at a much faster pace than that occurred in the developed countries. These countries have become aged before becoming rich, and hence are facing serious problems in meeting the health care needs of the rapidly increasing numbers of older people. The prevalence of NCDs rises rapidly with advance in age. Hence, the older people represent another target group (target 3.4 under SDGs) where health care services must be improved. Articles 4 and 5 examine problems caused by NCD among the older adults in Malaysia and China respectively. Malaysia's multi-ethnic country presents an excellent setting for a study of ethnic differentials in NCDs and the impact of these diseases on health and wellbeing of the people. China has the largest older population aged 60 and over, whose number is projected to reach 400 million by 2050. The China Longitudinal Health and Longevity Survey (CLHLS) provides excellent data for in-depth analysis of NCD affecting the oldest old.

In Malaysia, arthritis, HBP, diabetes, asthma and coronary heart disease (CHD) were the leading NCDs, in that order. NCDs, especially CHD, have disabling effects on the elderly. Older females were more likely than males to have arthritis and HBP, but the reverse is true for asthma. Chinese were least likely to report poor health while Indians and other indigenous groups were most likely to do so. It is important to promote healthy lifestyle and to have early detection and intervention of NCDs.

Cardiovascular diseases were the most common disease among older people in China. Neurological disorder was less common but it had the most disabling impact. About 10.0 percent, 3.1 percent and 3.1 percent of the older people were disabled by cardiovascular, musculoskeletal and sensorial diseases. The prevalence of chronic diseases rose sharply with age, by between 38 percent to as much 533 percent for neurological disorder, as they grew older by 9 years between 2002 and 2011. All these diseases have resulted in an increased burden of disability among the oldest old in China. A better health care system is needed to control and manage chronic diseases.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

An extensive review of the literature was carried out on topics covered in the five published articles for this thesis. These topics include fertility analysis, abortion, utilization of health services for delivery, and non-communicable diseases (NCDs). Contraceptive use is an important proximate determinant and also an integral part of reproductive health, as spelt out in the Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), and hence it was also included in the literature review.

Thousands of articles have been written on each of the five topics. For practical purposes, the search was limited to topics directly related to this thesis. While the main focus of the literature review is recent work (2000 onwards) in and on the developing countries, some of the relevant earlier studies, and studies in the developed world were also included in the literature review.

2.2 Fertility Analysis

2.2.1 Socio-economic Determinants of Fertility

There is a vast literature on the socio-economic determinants of fertility. The common socio-economic predictors of fertility are women's education and employment, place of residence, family wealth or income. In these studies, fertility level at the macro and micro level were found to be strongly negatively correlated with educational attainment of

women and husbands (Shi, 1990; Adamchak & Mbizvo, 1994; Martin, 1995; Mturi & Hinde, 2001; van Ginneken & Razzaque, 2003; DeRose & Ezech, 2005; Gubhaju, 2007; Jones, 2007; Skirbekk, 2008; Jain & Ross, 2012). Higher educated women are more likely to work in the modern sector where work and maternal roles are incompatible, and they are also more likely to desire fewer children, have better access to family planning information and service, as compared to lesser educated women.

An analysis of micro data from the 1970 and 1980 censuses from four Southeast Asian societies found that women's status contextual variables, particularly modern sector employment, have the largest and most consistent effect on lowered fertility (Hirschman & Guest, 1990). Female employment empowers women who place greater priority to career advancement than childbearing, resulting in fewer children than the non-working women (Engelhardt, Kogel & Prskawetz, 2004; Cáceres-delpiano, 2012; Broeck & Maertens, 2015). However, a positive employment-fertility relationship emerges as unemployment induces women to postpone childbearing, and labor market frictions can generate a positive association between the two variables (Da Rocha & Fuster, 2006).

Urbanization has a negative impact on the fertility level. Urban women tend to have fewer children than their rural counterparts, even after taking into account other variables (Bhat & Xavier, 2005; Gubhaju, 2007; Jones, 2007; Veron et al., 2008). The urban-rural fertility differentials can be attributed to the smaller desired family size among urban couples, and who have better access to family planning services.

The relationship between fertility and family income/wealth is inconsistent. In most studies, fertility is negatively correlated with family wealth or income (Boulier, 1982; Borg, 1989; Rosenzweig, 1990; Bloom, Canning & Malaney, 2000; Aarssen, 2005; El-Ghannam, 2005; Jones & Tertilt, 2006; Bollen, Glanville & Stecklov, 2007). Wealthier families tend to invest more on children's education, and the trade-off between 'quality over quantity' is an important contributing factor to fertility reduction in the developing countries that have made great stride in socio-economic development (Anderson & Kohler, 2013). However, a number of studies have found a positive correlation between income and fertility (Low, 2001; Micevska & Zak, 2002; Buhler, 2004; Gurmu & Mace, 2008). One explanation for the positive association between income and fertility is that the pronatalist stance of certain well-to-do segments of the society (Stanford & Smith, 2013). At the macro level, a panel study of 18 Latin American nations for over 45 years show that in general, childbearing declined during economic downturns (Adsera & Menendez, 2011). Countries with better social settings or stronger family planning programs tend to have lower fertility level than those with poorer settings or weaker programs (Jain & Ross, 2012).

Infant mortality has been found to be positively associated with fertility (Cochrane & Zachariah, 1983; Betzig, 1997; Cigno, 1998; Akin, 2005; Agus & Horiuchi, 2012; Jain & Ross, 2012). In high mortality setting, women have more babies to ensure the having the desired number of living children. Empirical evidence from the developed and developing countries since 1960 shows that the declining mortality has contributed significantly to fertility reductions, after a lag of about 10 years (Angeles, 2010). However, the effect of declining mortality on fertility in the developing counties is diminishing (Aksan, 2014).

Fertility is also affected by socio-cultural factors. Using data from DHS from 30 countries from Asia, Africa and Latin America, Heaton found that the level of development, social characteristics and proximate determinants play an important role in religious differences (Heaton, 2011). The extent of religiosity is important in explaining fertility levels in developing countries different degrees (Abeynayake, Bomhoff & Lee, 2012). Profound ethnic fertility differentials have also been found in a number of studies (Amin & Teerawichitchainan, 2009; McNamee, 2009).

2.2.2 Analytical Framework for Proximate Determinants of Fertility

Socio-economic variables can only affect fertility through the intermediate variables, which are in turn influenced by distal socio-economic, cultural and environmental factors. In their seminal work, Davis and Blake (1956) proposed an analytical framework that was later developed into a quantifiable model by Bongaarts (1978) for fertility analysis. The Davis-Blake framework consists a set of 11 intermediate fertility variables defined as the factors through which, and only through which, social, economic, and cultural conditions can affect fertility. These variables are divided into three categories, namely exposure to intercourse or the exposure to conception or gestation and successful parturition. Although widely accepted, this analytical framework could not incorporated easily into quantitative reproductive models (Bongaarts, 1982).

Bongaarts reorganized the intermediate variables and developed a simplified model, comprising four principal proximate determinants. Using historical data, he found that these four variables explained 96 percent of the variance of the fertility level of a population. The four determinants of regulated fertility are the proportion of females married, the prevalence of contraceptive use, the incidence of induced abortion, and the

fertility inhibiting effects of breastfeeding. The total fertility rate is expressed as a product of the four indices measuring their fertility inhibiting effects and total fecundity rate (TF) with a range between 13 and 17 and a mean of 15.3. The detailed formula is given in the paper on the Proximate Determinants of Fertility in Peninsular Malaysia in Chapter 3 of this thesis.

2.2.3 Salient Findings from Applications of Bongaarts' Analytical Framework

Bongaarts' model has been used in hundreds of published articles on proximate determinants of fertility in different parts of the world over the last four decades (Singh, Casterline & Cleland, 1985; Onuoha, 1992; Warren et al., 1992; Stover, 1998; Visaria, 1999; Sibanda, A et al., 2003; Kabir, Islam & Patwari, 2005; Moses & Kayizzi, 2007; Erfani & Mcquillan, 2008; Amin & Teerawichitchainan, 2009; Hammoudeh & Hogan, 2012; Lai & Tey, 2014). Owing to the unavailability of data on induced abortion, the fertility inhibiting effects of abortion was not estimated in a number of studies (Bongaarts & Potter, 1983; Singh, Casterline & Cleland, 1985; Onuoha, 1992; Sibanda, Amson et al., 2003; Baschieri & Hinde, 2007; Erfani & Mcquillan, 2008; Hammoudeh & Hogan, 2012). In one of the studies, all fetal wastage including miscarriage, abortion and stillbirth was used instead of abortion (Onuoha, 1992).

In most of these studies, marriage and contraception were by far the two most important proximate determinants of fertility, as observed in China (Coale, 1984; Poston Jr., 1986; Feeney et al., 1989; Kaufman, 1993; Tu, 1995; Zhang, 2004), Nepal (Ross et al., 1986), Turkey (Koc, Hancioglu & Cavlin, 2008), Malaysia (Tey, Ng & Yew, 2012), Vietnam (Das, Das & Thi Ngoc Lan, 2013), and Ethiopia (Sibanda, A et al., 2003). Contraceptive use was the most important proximate determinants of fertility in Central and South Asia as in the case of Bangladesh (Onuoha, 1992; Kabir, Islam & Patwari, 2005; Kabir et al., 2008); India (Visaria, 1999); Palestine (Hammoudeh & Hogan, 2012); and Iran (Erfani & Mcquillan, 2008). In contrast, contraceptive prevalence was not an important proximate determinants of fertility in Africa, but it has been gaining importance since 1980s (Onuoha, 1992). Declines in contraceptive use and increases in unmet need for family planning have led to the stalling of sub-groups in Kenya, Tanzania, Uganda and Zimbabwe (Ezeh, Mberu & Emina, 2009).

The fertility inhibiting effect of breastfeeding is relatively insignificant in Asia in the more recent years (Erfani & Mcquillan, 2008; Tey, Ng & Yew, 2012). However, it is the most influential determinant in Tanzania (Kravdal, 2001), Senegal (Onuoha, 1992) and Egypt (Baschieri & Hinde, 2007). But all these are changing fast. In Senegal, the magnitude of the change for the period 1978-1986 is greatest in contraceptive use and least in duration of breastfeeding.

In countries where abortion data are available, studies showed that it is not an important determinant of fertility in Bangladesh (Kabir, Islam & Patwari, 2005) and India (Visaria, 1999). In an earlier study based on DHS data from 21 developing countries, Johnson and Hill (1996) showed that abortion was as important as contraceptive use in influencing fertility in the 1970s.

There has been significant changes in the relative importance of the proximate determinants of fertility. An analysis of nationally representative data from Bangladesh over the period of 1975 to 1999-2000 reveals the emergence of contraception as the principal determinant of fertility, replacing postpartum lactational infecundability, which was the most important until early 1990s (Mazharul Islam, Ataharul Islam & Chakroborty, 2004). This finding was confirmed by a recent study which shows that a little more than half of the births averted in 2011 was due to contraception, up from 8 percent in 1975, while the proportion of births averted by breastfeeding had declined from 74 percent to 25 percent (Rashedul Islam et al., 2015). In Palestine, contraceptive use and breastfeeding accounted for about 15.5 percent and 4.5 percent reduction in fertility respectively for the period 1996- 2006, while marriage postponement resulted in 6.7 percent reduction in Gaza Strip as compared to a mere 1.9 percent in the West Bank (Hammoudeh & Hogan, 2012).

2.2.4 Limitations of Bongaarts' Model

Bongaarts' model is rather simplistic. It is based on four principal proximate determinants and the assumption of a standard TF of 15.3 for all populations. The simplicity and ease of use of this model is seen to compromise the demographic and statistical rigor (Moreno, 1991). The applicability of this model in certain settings has been questioned. The main criticisms of the model are related to pathological sterility, sexual activities outside marriage, and the availability and reliability of information pertaining to abortion, as well as use effectiveness of contraception.

One of the criticisms of the model is the assumption that sexual activities and childbearing occur only within marriage. In many regions, such as the Former Soviet Unions and Central and Eastern Europe, where so much childbearing occurs outside of marriage, it is not correct to use marriage as a determinate of fertility (Heleniak, 2010). The appropriateness of using contraceptive prevalence rate to measure the fertility inhibiting effects has been questioned. Reinis (1992) argued that Bongaarts' model does not work well when 'women employ stopping behavior once they have achieved their desired family size', and the impact of contraceptive use tends to be under-estimated. Moreover, values for use effectiveness of methods are fixed rather arbitrarily.

Reliable data on abortion is rarely available. Because of the lack of data or the assumption that abortion is rare, many studies have not included abortion in the models. In settings where secondary sterility caused by high rates of sexually transmitted diseases, there is a need to isolate the effects of pathological sterility on fertility (Heleniak, 2010).

Bongaarts' model puts the TF between 13 and 17 with a mean of 15.3. In many of the studies, the estimated TF values are outside this range, and vary widely across studies. In India, Visaria (1999) estimated the mean TF at 11.8 as at 1999, while Jain (1997) put the TF value at a range of 13.0 to 13.3 for early 1970s. A study using 1997 data found that a Yemeni woman whose marriage remained intact throughout her reproductive age span, used no contraception, not gone for induced abortion and did not breastfeed, had the potential to produce 16.83 children (Saxena, 2005).

2.2.5 Revised Bongaarts' Model

In revising the model proposed by Bongaarts in 1978 and 1982, Bongaarts and Potter (1983) attributed the fertility changes to changes in the index of marriage, contraception and post-partum infecundability, and to changes in the remaining proximate variables - natural fecundability, spontaneous intra-uterine mortality, and permanent sterility. In this model, the contribution of each of the marriage, spacing, and limiting components is measured as the sum of a main effect, i.e. the difference between total fertility due to the observed change in the corresponding factors, when the other two are held constant; and the sum of a linear combination of four interactions, or higher-order terms (Bongaarts & Potter, 1983; Sibanda, A et al., 2003; Erfani & Mcquillan, 2008).

In the revised model by Stover (1998), the main changes are: (i) the use of sexual activities instead of marriage, making it more applicable in settings where out-of-wedlock sexual activities are common, (ii) incorporate pathological sterility, (iii) take into account the overlap between contraceptive use and infecundity, (iv) adjust the overlap between contraceptive use and postpartum amenorrhea, and (v) change from total fecundity to potential fertility, fixed at 21, instead of 15.3 for TF in the original model.

2.2.6 Discussion

Notwithstanding its limitations, Bongaarts' model is a practical tool and conceptually useful. It is arguably the most widely used tool for assessing the impacts of the proximate determinants of fertility since its development in 1978 when demographic data were scarce. Hundreds of studies have applied the model using individual data. The use of a common tool in analyzing fertility allows for comparisons of the results over time and

across settings. With the availability of new data from DHS, large scale national surveys and service statistics, more studies can be carried out to examine the links between each of the proximate determinants and various socio-economic and cultural and environmental factors to provide a better understanding of the demographic dynamics for policy making, as the world braces for low fertility and the attendant consequences.

2.3 Contraception

The availability of contraceptive methods and services has allowed couples to plan for the number and timing of births. Contraceptive use has contributed to improved reproductive health and in reducing unwanted pregnancy and maternal mortality. Contraception is an important proximate determinant of fertility that plays a major role in fertility reduction in many developing countries (Islam, Mamun & Bairagi, 1998; Balal, 2009; Rahayu, Utomo & McDonald, 2009; Moreland, Smith & Sharma, 2010).

There has been a proliferation of research on contraceptive use by social scientists. This sub-section provides a brief review of literature on the following topics:

- Trends and differentials in contraceptive use
- Method mix
- Unmet need for contraception and barriers to contraceptive use
- Accessibility and use of contraception among adolescents
- Linkages between family planning and reproductive health

2.3.1 Trends and Differentials in Contraceptive Use

The most recent data on contraceptive and method mix for each country are compiled and reported by Population Division of the United Nations (UN) has been updating contraceptive prevalence rate (CPR) and the method mix for individual countries. World Contraceptive Use shows that globally CPR had increased from 36 percent in 1970 to 55 percent in 1990, and 64 percent in 2015. Almost all sub-regions, except for those where contraceptive prevalence was already high in 1990, had recorded an increase in contraceptive prevalence and a decrease in unmet need for family planning between 1990 and 2010, although the pace of change over time varied between countries and sub-regions (Alkema et al., 2013; United Nations Population Division, 2015). However, CPR varied widely across regions and countries from 33 percent in Africa to 75 percent in Northern America (United Nations Population Division, 2015). An earlier analysis by Seiber, Bertrand and Sullivan (2007) also found that CPR increased in all regions of the developing world, reaching 66 percent in Asia and 73 percent in Latin America and the Caribbean in 2000–2005, but only 22 percent in sub-Saharan Africa.

As of 2014, the CPR was only 6 percent in Chad and 12 percent in Sudan. While China has registered a very high CPR of 84 percent, the other demographic giant, India, had a much lower CPR of 55 percent. Many countries have made remarkable progress in CPR, as in the case of Indonesia and Bangladesh, where CPR had risen from about 8 percent in the 1970s to around 62 percent in 2014. CPR is higher in developing countries where contraceptive methods are readily accessible. This is confirmed by a study by Ross et al. (2002) who found that prevalence is highest in countries where access to female sterilization, intrauterine device (IUD), pill and condom is uniformly high.

Sub-Saharan Africa region has the lowest CPR, with pronounced variations in the level and trend across countries. Using data from Demographic and Health Surveys (DHS), Creanga et al. (2007) found that CPR has increased substantially in Ethiopia, Madagascar, Mozambique, Namibia and Zambia but has declined slightly in Kenya, Senegal and Uganda. Wealth-related inequalities in the met need for contraception have decreased in most countries, but women in the richest wealth quintile were still more likely than those in the poorest quintile to practice long-term contraception.

2.3.2 Method Mix

The 2015 World Contraceptive Report indicates that nine out of ten contraceptive users worldwide rely on modern methods, and these were the methods used by at least three in four users in 148 countries. However, modern methods constituted less than half of all contraceptive use in 11 countries mainly in Middle Africa and Southern Europe where withdrawal and rhythm are widely use.

Female sterilization and IUD are the two most common methods, used by 19 percent and 14 percent respectively. Among the short-term methods, the pill, male condom and injectables each contributed 9 percent, 8 percent and 5 percent respectively. The ranking of the methods follows roughly similar pattern in the developing countries – about a decade ago male condom had overtaken the injectables at fourth place (Lande & Richey, 2006). However, female sterilization is little used in the Near East, North Africa or sub-Saharan Africa (Population Reference Bureau, 2002).

Overall, short-term and reversible methods, such as the pill, injectables and male condom, are more common than other methods in sub-Saharan Africa and Europe whereas long-acting or permanent methods, such as sterilization, implants and the IUD, are more common in Asia and Northern America. Modern methods accounted for 95 percent or more in most countries in the Caribbean, Eastern Africa, South America, Southern Africa and Western Europe (United Nations Population Division, 2015).

Of the 109 low and middle income countries included in an analysis, 30 percent had a skewed method mix – in which a single method accounts for more than half of contraceptive use. This pattern did not change much since 2006 (Sullivan et al., 2006; Bertrand et al., 2014).

2.3.3 Unmet Need for Contraception and Barriers to Contraceptive Use

The level of unmet need for family planning among married or in-union women had declined from 22 percent in 1970 to 12 percent in 2015. The level of unmet need for contraception is higher in the least developed countries and sub-Saharan Africa, at 22-24 percent. Excluding users of traditional methods, 18 percent of married or in-union women worldwide had an unmet need for modern methods in 2015. Unmet need for family planning in 2015 ranged from less than 10 percent in 36 countries across all major areas to 30 percent or more in 15 countries, mainly in Africa (United Nations Population Division, 2015).

Globally, the number of women aged 15-49 years who were married or in a union having an unmet need modern contraception had increased from 210 million in 2003 to 225 million in 2014. The large number of women with unmet need for family planning has profound health and social implications, as it resulted in about 74 million unintended pregnancies yearly in developing regions. If all unmet need for modern methods were met, 52 million of these unintended pregnancies could be averted, thereby preventing the deaths of 70,000 women from pregnancy-related causes (Singh, Darroch & Ashford, 2014). With an estimated one billion potential contraceptive users in 2015, largely in developing countries, there is an urgent need to increase investment to meet demand for contraceptive methods and improve reproductive health worldwide (Alkema et al., 2013).

The highest proportion of unmet need for contraception was found in sub-Saharan Africa (Delbiso, 2014), where it was twice as common this region as in Latin America (Sedgh et al., 2007). Within Latin America, it is twice as high in the poorest fifth of the population as in the wealthiest fifth (Cleland et al., 2006). Disparities in unmet need contribute to even wider gaps in maternal mortality rates (UNFPA, 2007; Turquet, Watt & Sharman, 2008).

DHSs show that within each country, there are wide variations in unmet need for contraception. In Pakistan, there were 5.7 million women with an unmet need (2.4 million for spacing and 3.3 million for limiting). Unmet need decreases with age, increases with the number of children and increasing education, and is higher among poor women. Structural factors such as rural residence and exposure to family planning programs and messages are relevant for unmet need for spacing. There were twice as many women in Pakistan with an unmet need for family planning than those who had access to family planning services. In Ethiopia, although unmet need for contraception declined from 36

percent in 2000 to 25 percent in 2011, it is still far from satisfying the demand. Age, educational level, number of children and religion were significant correlates of unmet needs for spacing and limiting. Place of residence was a significant correlate for spacing while age at marriage and knowledge of contraceptives were significant correlates for limiting.

Lack of contraceptive knowledge was not the main reasons for unmet need. A study in 52 developing countries reveals that the reasons for non-use include concerns about contraceptive side effects and health risks (26 percent), having sex infrequently or not at all (24 percent), opposition to family planning own self or by family members (23 percent), and breastfeeding and/or haven't resumed menstruation after a birth (20 percent) (Sedgh, Ashford & Hussain, 2016).

Barriers to family planning vary across settings but the most common factors include fear of side effects and service accessibility. In developing countries, barriers to family planning include poverty and illiteracy, family size, security and safety, particular sex preference, filial piety, distrust of outsiders and political unrest, religious barriers, fear of side effects, limited access and choice (Konje & Ladipo, 1999). In sub-Saharan Africa, the major barriers found to prevent uptake of services included cultural and societal pressure on women, socio-economic status, financial barriers, and regional barriers associated with lack of access to services (Haider & Sharma, 2012). In Kenya and Nigeria, fear of side effects and adverse reactions were a major barrier to use (Omideyi et al., 2011; Kinaro et al., 2015). Many fears were based on myths and misconceptions. Young women learn about both true side effects and myths from their social networks (Ochako et al., 2015). In some settings, unfavorable perceptions played greater role compared to barriers such as sexual partner communication, opinion on adolescents to use a contraceptive and

ability to seek contraceptives (Kinaro et al., 2015). The low usage of contraception in the rural areas of Pakistan correlates with the level of isolation, poverty, illiteracy, and to a large extent, religious misinterpretations/misconceptions. Almost 25 percent of Pakistani couples who desired family planning services were not receiving them for a variety of reasons of which religion could be one, especially in the rural remote areas where the media is still not reaching and influencing mind-sets (Shaikh, Azmat & Mazhar, 2013).

2.3.4 Accessibility and Use of Contraception among Adolescents

There were limited data on contraceptive use among unmarried adolescents. A significant proportion of women commence sexual activity and childbearing during adolescence, with low contraceptive prevalence and high unmet need for contraception. Adolescent women were found to have lower use of contraception, poorer knowledge of family planning and less access to information and services than adult women (Kennedy et al., 2011).

In many developing countries, the proportion of adolescents using contraceptives increased substantially over the last two decades. However, adolescents tended to have shorter periods of consistent use with more contraceptive failure and more stopping for other reasons. As large number of young people are entering reproductive age, contraceptive use will be increasing (Blanc et al., 2009).

In a study in Malawi, it was found that the impact of unwanted pregnancy and unsafe abortion to be the greatest on young women. Premarital and extramarital pregnancies were highly stigmatized; stigma directly related to abortion was also found. Unwanted

pregnancies occur among women who have limited access to family planning and safe abortion (Levandowski et al., 2012).

2.3.5 Linkages between Family Planning and Reproductive Health

There is a wide body of literature on the links between family planning and maternal health. Studies show that helping women and couples plan their families and have healthy babies with good reproductive health care will contribute directly to attaining three MDGs: (i) reducing child mortality, (ii) improving maternal health, and (iii) combating HIV/AIDS. Improving contraceptive services may also make meeting other MDGs, such as achieving universal primary education, reducing endemic poverty and promoting women's empowerment and equality, easier and more affordable (Vlassoff et al., 2011). Family planning prevents mother-child transmission of HIV, contribute to birth spacing, lower infant mortality risk, and reduce the number of abortions, especially unsafe ones. Family planning has also been shown to significantly lower maternal mortality and maternal morbidity associated with unintended pregnancy (Tsui, McDonald-Mosley & Burke, 2010). Family planning could prevent as many as one in every three maternal deaths by allowing women to delay motherhood, space births, avoid unintended pregnancies and abortions, and stop childbearing when they have reached their desired family size (Collumbien, Gerressu & Cleland, 2004). Increasing contraceptive use in developing countries has cut the number of maternal deaths by 40 percent over the past 20 years, merely by reducing the number of unintended pregnancies. By preventing high-risk pregnancies, especially in high-parity women, and those that would have ended in unsafe abortion, increased contraceptive use has reduced the MMR by about 26 percent within a decade. A further 30 percent of maternal deaths could be avoided by fulfillment of unmet need for contraception (Cleland et al., 2012).

Use of contraception is a substantial and effective primary prevention strategy to reduce maternal mortality in developing countries. In 172 countries, 342,203 women died of maternal causes in 2008, and contraceptive use averted 272,040 maternal deaths. As numbers of unwanted pregnancies and unmet contraceptive need are still high in many developing countries, satisfying unmet need for contraception could prevent another 104,000 maternal deaths per year (Ahmed et al., 2012).

Meeting women's need for modern contraceptives would prevent about one quarter to one third of all maternal deaths, saving 140,000 to 150,000 lives a year (Singh et al., 2003; Collumbien, Gerressu & Cleland, 2004). It would also prevent a similar proportion of the injuries, infections, and long-term disabilities that result from pregnancy, childbirth, and abortion and affect an estimated 15 million women annually (UNFPA, 2005). Integration of HIV and family planning programs has the potential to meet the need for HIV and pregnancy prevention more efficiently (Pachauri, 1994; Prata, Sreenivas & Bellows, 2008).

In Nigeria, family planning is not widely practiced and this has resulted in unplanned pregnancy. Many young women with low educational attainment and from poor families resorted to abortion to terminate unwanted pregnancy to avoid social stigma. Though induced abortion is negatively viewed in the community, it is still common, and women usually patronize quacks to obtain such services (Omidoyi et al., 2011). In 2013, an estimated 40 percent of pregnancies in Cameroon were unintended, and more than six in ten women had unmet need for modern contraception. It was estimated that meeting just half of this unmet need would prevent 187,000 unplanned pregnancies worldwide each year, resulting in 65,000 fewer unsafe abortions and 600 fewer maternal deaths annually. If all unmet need for modern methods were satisfied, maternal mortality would drop by

more than one fifth, and unintended births and unsafe abortions would decline by 75 percent (Vlassoff et al., 2014). In a similar study in Malawi, Vlassoff and Tsoka (2014) estimated that if all unmet need for modern contraception were met, maternal mortality would decline by more than two fifths, and unintended births and unsafe abortions would drop by 87 percent.

2.3.6 Discussion

There is a large body of literature about family planning and contraceptive use. Research interest on contraceptive use and its impact on fertility and reproductive gained momentum since the 1994 International Conference on Population and Development (ICPD) and persists to this day. Unmet need for contraception has gained the most attention, because of its impact on reproductive health and well-being. Data and research findings show substantial improvement in CPR and reduction in unmet need in the developing world, but wide disparity remains across regions/countries and within country.

Family planning researchers and policy makers have often overlooked the importance of involving men in couples' fertility choices and contraception, despite the fact that male involvement is a vital factor in sexual and reproductive health programming (Okigbo et al., 2015). Research on contraceptive use has focused on married women, and most Knowledge, Attitude and Practices (KAP) surveys only interviewed married women in the reproductive age. Studies suggest that a husband plays an influential role in a woman's contraceptive use, but the role of men in family planning is understudied (Aspilcueta-Gho, 2013; Kabagenyi et al., 2014; Mboane & Bhatta, 2015). Greater integration of reproductive health care matters with the MDGs and increasing perception of men

through enrolment in various components of reproductive activities will produce synergistic effects (Shahjahan et al., 2013).

Contraceptive accessibility and use among adolescents is also understudied. The UN field inquiry found that adolescent sexuality is a problem in most of the developed and developing countries. However, inadequate attention has been given to research on the needs for contraception among them.

2.4 Attitudes toward Abortion and Abortion Education

Unsafe abortion is an important public health problem, accounting for 13 percent of maternal mortality in developing countries. Unsafe abortion resulted in 70,000 deaths annually worldwide, and 99 percent occurred in the developing countries. Factors associated with increased maternal mortality from unsafe abortion in developing countries include inadequate delivery systems for contraception needed to prevent unwanted pregnancies, restrictive abortion laws, negative attitudes towards induced abortion, and poor health infrastructures for the management of abortion complications (Okonofua, 2006). Preventing abortion mortality and morbidity in countries where they remain high is a matter of good public health policy, based on good medical practice, and an important part of initiatives to make pregnancy safer (Berer, 2002).

Universal access to safe, acceptable and affordable contraception will reduce the need for abortion. However, the contraceptive prevalence remains low and unmet need is still high in the developing regions, especially in sub-Saharan Africa, resulting in high rate of unsafe abortion.

Despite relatively liberal abortion law, women continue to seek unsafe, illegal abortions. There are many barriers to abortion services such as the cost, restrictive laws, unavailability of services, and socio-cultural factors. In many countries, there is serious shortage of trained abortion providers. Hence, there is a need to step up abortion education and training, and to create more supportive environment for the providers.

This section presents literature review on attitudes toward abortion and abortion education. It also includes a review of literature on the linkage between contraceptive use and abortion, as both are the important elements of reproductive health. Reducing unmet for contraception and unsafe abortions are two of the main targets under MDGs and SDGs.

2.4.1 Attitudes toward Abortion

Understanding the knowledge and opinions about abortion of the public, especially those of young people, is essential in designing programs to reduce the problem of unsafe abortion. Training in abortion among medical professionals and their attitudes toward abortion affect the availability of services. Medical students' knowledge of and attitudes toward abortion should be taken into account in including abortion training in the curriculum to overcome the problem of provider shortage. Most research on knowledge of and attitudes toward abortion were conducted in the United States and Europe, and there is a dearth of research on abortion in the developing countries.

Medical students and practitioners in North America and Europe generally have positive attitudes towards the legality and availability of abortion (Shotorbani et al., 2004; Myran et al., 2015). However, a survey among medical students in Canada found that only one in three planned to enter a specialty in which abortion would be within the scope of practice, and less than 10 percent would provide abortion services (Myran et al., 2015). In another survey in Canada, about one third each would provide an abortion service, or make reference to a provider in their future practice (Cessford & Norman, 2011).

A 1999 survey conducted in a fairly typical state-supported medical school in the United States found that the majority of students supported the broad provision of reproductive health services; and of the 43.4 percent of students who anticipated a career in family practice, most expected to provide abortions in their future practices (Rosenblatt et al., 1999). A survey of students in the health service programs in the United States found that 70 percent would approve of abortion under any circumstances. About two thirds would attend a program whose curriculum requires abortion training, and one in three intended to provide medical abortion in future practice (Shotorbani et al., 2004). Reasons cited for the provision of abortion include patient need, adequate training, and their personal beliefs. Residency training and religious beliefs affect the likelihood of provision of abortion service by obstetrician, but situational factors are also important (Steinauer et al., 2001).

Although Great Britain's abortion law is more restrictive than those in many other developed countries, general practitioners have largely positive attitudes toward women's access to abortion and toward the existing law. A survey found that four in five doctors in a survey in Britain were pro-choice, and three in five supported the liberalization of the current law to give women to exercise their reproductive right. Three out of four

suggested the provision of free abortions by the government. Among doctors who were broadly anti-abortion, only one fifth favored women's right to choose (Francome & Freeman, 2000).

In contrast to their counterparts in the West, medical students in developing countries tend to be less positive towards abortion. In India, although abortion is legal for a long time, unsafe abortion continues to be a public health concern. A recent survey conducted in India found that most students viewed abortion as a serious health problems in India, one quarter considered abortion to be morally wrong, and one fifth would not approve of abortion for unmarried women (Sjostrom et al., 2014). In South Africa, there were moral objections to abortion among medical students. Female medical students were more supportive of the availability of abortion and women's autonomy compared with males (Patel & Kooverjee, 2009). In Ethiopia, a country where abortion is legal, most midwives were willing to provide abortion services. There are complex dynamics underlying midwives' willingness to offer services, including conflicts between professional norms and religious beliefs (Holcombe, Berhe & Cherie, 2015).

Zimbabwe has a restrictive abortion law. However, 61 percent of doctors were supportive of medically supervised abortion, but the nurses were equally split with about 42-43 percent for or against. Three quarters of the doctors viewed the present abortion law as restrictive and more than half wanted change. Knowledge of the dire complications of unsafe abortion rather than religion influences doctors' s attitude to abortion (Kasule, Mbizvo & Gupta, 1999).

In Zambia, abortion is generally viewed as immoral. However, such perception was not associated with lack of support for legalization, but rather the belief that women need access to safe services. These findings suggest that increasing awareness about abortion law in Zambia may be important for encouraging more favorable attitudes (Geary et al., 2012).

The highly restrictive abortion laws in Latin America and the Caribbean are not reflective of public opinion on abortion. Yam, Dries-Daffner and Garcia (2006) found that the majority of populations surveyed were in favor of abortion under a greater number of circumstances than are permitted in their respective countries, particularly in cases of rape and threat to life or health.

Adolescent sexuality is becoming a major social problem worldwide. Unwanted pregnancy as a result of unprotected sex has led to the rise in abortion among young people. Owing to the lack of knowledge on the legal status and availability of services, young pregnant women often resort to unsafe abortion. A 2000 survey on young people in Mexico found that a little more than half of young people aged 15-24 did not know the legal status of abortion. Majority supported legal abortions when pregnancies result from rape or endanger a woman's life or health, but most would not approve of abortion for the unmarried or minors, as well as on ground of economic constraints and contraceptive failure. Low education and conservative attitudes toward emergency contraceptive were the main contributory factors towards conservative attitudes toward abortion (Becker, Garcia & Larsen, 2002).

Religion plays a major role in shaping attitudes toward abortion. A survey in Brazil indicates those who frequently attend Pentecostals and Catholics demonstrate the strongest opposition to the practice of abortion, as well as its legalization. Additional religious factors, such as a commitment to biblical literalism, were also found to be significantly associated with opposition to both abortion issues (Ogland & Verona, 2011).

A survey among providers in India found high levels of interest in abortion training and provision of services. Physicians having a more permissive attitude towards abortion and currently providing abortion using any pharmacological drugs, especially those from the public facilities were more likely to express an interest in attending training. The positive view on abortion among providers can be used as a basis to expand the pool of cadres that can legally provide safe abortion care (Patel et al., 2009). While Patel et al. (2009) found private sector practitioners were less likely to show an interest in abortion training as compared to those from the public sector, the opposite was found by Creanga, Roy and Tsui (2008). They also found that private providers were more likely to offer abortion services, including medical abortions. Aspects related to medical abortion's market demand, its safety, efficacy and perceived ease of delivery weigh more than patients' rights and personal interests on providers' decision to provide medical abortions.

Among women aged 15-44 in Nepal, about 6 out of 10 knew of a place to have an abortion and about 40 percent were aware of the legal status of abortion. Women with little or no education and those from poorer families were least knowledgeable, and hence there is a need to intensify efforts to educate women in Nepal, particularly the most disadvantaged women, about abortion law, including the conditions under which abortion is permitted, and where to access safe abortion services (Thapa, Sharma & Khatiwada, 2014).

The continuing decline in fertility despite stalling of contraceptive use in Malaysia has raised speculation that abortion is on the rise. Malaysia has a fairly liberal law on abortion and abortion services can be obtained from private and public health facilities. Reliable data on abortion is not available (Tey et al., 2012). Some health care providers in Malaysia were unaware of the legal status of abortion in the country, and were influenced by their personal beliefs with regard to provision of abortion services. As a result of the lack of knowledge and understanding on the part of the providers, women are facing difficulties in accessing abortion information and services (Low et al., 2015).

2.4.2 Abortion Education

The declining number of abortion providers in the United States has been attributed to a lack or decrease in abortion training in obstetrics and gynecology (ob-gyn) residency programs (Steinauer et al., 2001; Steinauer et al., 2003; Espey et al., 2005; Foster et al., 2006). Abortion training availability was found to be positively correlated with providing abortion in future practice (Steinauer et al., 2008). Recent evidence suggests that medical schools offer insufficient training to equip students with the knowledge and skills necessary to counsel patients about abortion and to provide abortion services.

Abortion education is acceptable and valued by medical students and should be integrated into the curricula of all medical schools (Hwang et al., 2005; Espey et al., 2008). Making abortion a standard part of clinical training would ameliorate the abortion provider shortage (Shotorbani et al., 2004). Hence, there is an urgent need for curriculum reform to improve abortion training to provide future practitioners to improve reproductive health care for women (Cessford & Norman, 2011). Perceived barriers to providing medical abortion are amenable to change. Policies and programs are needed to

ensure that interested, committed clinicians can overcome barriers to providing medical abortion for their patients (Hwang et al., 2005).

Most Canadian ob-gyn programs offer some training in elective abortion, but only half include it routinely. Integrated abortion training was associated with greater resident participation in training and increased likelihood of intention to provide abortions after residency (Roy et al., 2006). Myran et al. (2015) found that lack of social support and inability to obtain abortion training were the two potentially modifiable barriers to abortion provision, and this calls for formulating policies to promote medical abortion as a method of improving access to safe abortion.

Family medicine programs can be successful at developing required abortion training. Collaboration with colleagues inside and outside the family medicine department and with receptive training sites will benefit programs interested in such (Dehlendorf et al., 2007). Abortion training may also be provided as off-site educational programs, as demonstrated by the Planned Parenthood's experience in teaching residents from local hospitals to perform first-trimester abortion using local anesthesia (Castle & Hakim-Elahi, 1996).

There is a dearth of research on abortion education in the developing countries. A survey in Mexico shows that most medical abortion providers used ineffective protocols. Among the providers, a high proportion wanted more training in medical (87 percent) and surgical abortion (69 percent), but it was much lower for the non-providers, at 49 percent and 27 percent respectively. The interest shown by medical students in providing abortion services and the prevalent use of ineffective medical abortion regimens call for a need to review the curriculum to strengthen abortion training in Mexico (Dayananda et al., 2012).

A survey on medical students in Malaysia found that majority (90 percent) wanted to have more training on the general knowledge and legal aspects of abortion, and pre-and post-abortion counseling. About 8 in 10 were in favor of including abortion training in the curriculum, while the majority of the rest were neutral in their opinion. The fact that majority of the students had intention to provide abortion counseling and services in their future practice should be taken into account in the new curriculum. Abortion education is an important step towards making available safe abortion services to reduce unsafe abortion (Tey et al., 2012).

2.4.3 Abortion and Contraception

Primary prevention of abortion includes the promotion of increased use of contraception by women (and by men) at risk for unwanted pregnancy (Okonofua, 2006). Contraceptive use would reduce the number of unintended pregnancies, unsafe abortions and maternal deaths. But why is induced abortion common in environments in which modern contraception is readily available? Researchers have examined the linkage between contraceptive use and abortion and provided some explanations on the reasons for the high abortion despite the availability of contraception (Gorbach et al., 1998; Rahman, DaVanzo & Razzaque, 2001; Marston & Cleland, 2003; Visaria et al., 2004; Moore, Singh & Bankole, 2011; Tsui et al., 2011).

Based on their analysis, Rahman, DaVanzo and Razzaque (Rahman, DaVanzo & Razzaque, 2001) explained that abortion may increase during the fertility transition in less developed countries as the desire to limit family size increases unless there is widespread availability of quality family planning services. In a cross-country study in the developed and developing regions, rising contraceptive use was found to result in reduced abortion incidence in settings where fertility itself is constant. However, the parallel rise of contraception and abortion was observed in settings where fertility was falling rapidly and the increased contraceptive use alone was inadequate to meet the growing demand for fertility regulation (Marston & Cleland, 2003).

In a five countries study (United States, Nigeria, Pakistan, Peru and Mexico), Tsui et al. (2011) found that across all settings, women and men rarely weigh the advantages and disadvantages of contraception and abortion before beginning a sexual relationship or engaging in sexual intercourse. The two are linked only when contraception is used to prevent repeat abortion. Fear of side effects is one of the main reasons for non-use of contraception. On the other hand, abortion experience raises the spectre of social stigma and motivates better practice of contraception. In all settings, male partners play an important role in pregnancy decisions and management.

A survey of 504 rural and 523 urban women of childbearing age in Vietnam found that use of an IUD reduced the likelihood of subsequent abortion, but use of traditional method increased women's likelihood of a subsequent abortion. Contraceptive use is a better predictor of abortion as compared to socio-demographic factors (Gorbach et al., 1998). In certain settings, abortion was used as a means for fertility regulation, as in the case in Nigeria, where a survey shows that only 13 percent of the women in the reproductive age groups were using modern contraception, while about 42 percent had had induced

abortion. In addition, 15 percent of women surveyed used both contraception and abortion for fertility control (Owonikoko et al., 2012).

Negative attitudes toward contraception affect its use and in turn results in unwanted pregnancy which ends up in abortion. In Curacao, the low CPR and high abortion rate was due to the misconception and negative attitude toward reliable contraceptives and limited sexual education. Contraceptive cost also posed as a barrier to its use (van den Brink et al., 2011).

Poor couple communication, lack of planning, lack of acceptable contraceptive methods and the pleasures that people associate with having unprotected sex result in the perception that some individuals rely on abortion over contraception to prevent unintended births (Moore, Singh & Bankole, 2011). An abortion experience can change future views and decisions towards contraception, as demonstrated by a study in Nigeria (Omideyi et al., 2011).

2.4.4 Discussion

Unsafe abortion is a serious public health problem, and there is a sizeable volume of literature on this subject. This review focuses on the attitudes of medical students and professionals, as their attitudes toward abortion and abortion training will determine the availability of trained personnel to provide safe abortion. Several studies have highlighted the shortage of trained providers due to various factors.

Abortion is a sensitive issue and data on abortion are not readily available. Research is also by the lack of reliable data on abortion are not readily available in many countries.

Owing to the data constraints, research on attitudes of abortion providers and abortion training as well as other aspects of abortion appears to be lacking in the developing countries. Most research on attitudes toward abortion, abortion training and problems related to unsafe abortion were based on small case studies, and were confined to small geographical areas. Almost all the research on abortion and abortion education were based on cross-sectional data, and hence the causal effects could not be determined. Few have taken into account contextual variables, which may be important in assessing the willingness of the health professional, including those who are undergoing training, to provide abortion services.

Medical schools play a very important role in training the abortion providers to reduce unsafe abortion. The transition from unsafe to safe abortions requires policy changes, abortion training, provision of services at appropriate service delivery points; and encouraging women to opt these services instead of those of untrained providers.

2.5 Utilization of Health Services for Delivery

Universal access to reproductive health services is one of the MDGs targets that has not been achieved. Large numbers of births in the developing countries were delivered outside a health facility. There are huge inequalities in the use of maternal and child health services, including skilled birth attendance. The odds of using a health facility for childbirth is much lower among those with little or no education, from poorer families and living in the rural areas as compared to those who have higher education, more well to do and living in the urban areas. A host of other factors such as culture, religion, women empowerment or autonomy, and exposure to media are also closely correlated with institutional delivery (Tey & Lai, 2013).

Institutional factors such as the accessibility (distance) and quality of health services are the main supply-side barriers. The cost of services and the poor quality of service, and the long distance are some of the main reasons that discourage women from using the health service for delivery. The demand-side barriers that include own belief and preference, lack of knowledge about service availability, husband's objection and religious belief are just as important as the supply-side barriers (Tey & Lai, 2013).

In the developing countries, traditional birth attendants (TBAs) have a major role in delivery of births. Women living in the rural areas and from the disadvantaged segment in term of education and family wealth are more likely to rely on TBAs for delivery (Tey & Lai, 2013). The majority of the TBAs are not properly trained to manage birth complications, which result in higher maternal mortality.

This section will focus on three main topics:

- Socio-economic correlates of utilization of skilled birth attendants (SBAs)
- Barriers to the utilization of health care services for delivery
- The roles of TBAs

2.5.1 Socio-economic Correlates of Utilization of Skilled Birth Attendants (SBAs)

Empirical research has provided ample evidence to show that women's education, family wealth and place of residence have the most significant and consistent effects on skilled birth attendance (Govindasamy & Ramesh, 1997; Shariff & Singh, 2002; Chakraborty et al., 2003; Woldemicael, 2007; Bashour et al., 2008; Ahmed et al., 2010; Agha & Carton, 2011; Jat, Ng & Sebastian, 2011; Zere et al., 2011; Tey & Lai, 2013). A study on inequities in skilled attendance at birth in Namibia found that most of the inequality in births attended by skilled health personnel, which is skewed towards the wealthier segment of the population, is explained by inequalities in income, education and urban residence (Zere et al., 2011). Besides, variables such as women empowerment and exposure to media are also important factors affecting service utilization. The socio-economic variables are themselves inter-correlated. For instance, higher education is associated with urban living, higher income, and better exposure to the media, all of which affect the use of health facilities for childbirth.

In almost all the empirical studies, higher educated women are much more likely than their lesser educated counterparts to make use of health services for delivery. The following studies show that higher educated women were at least twice as likely as rural women to be attended by a trained personnel during delivery. In a rural community in Pakistan, the percentage of births delivered in a health facility ranges from 33 percent among those with no schooling to 73 percent among those with higher education (Agha & Carton, 2011). In rural Bangladesh, the proportion attended by trained personnel ranges from 16 percent among those with no schooling to 45 percent among those with at least some secondary education (Amin, Shah & Becker, 2010). In India, the odds of institutional delivery among those with at least secondary education was 7.8 times higher

than those who were illiterate (Govindasamy & Ramesh, 1997). In Damascus, the proportion of birth attended by a doctor ranges from 26 percent among those with less than 7 years of schooling to 74 percent among those with at least 7 years of schooling (Bashour et al., 2008). Wide educational gaps in service utilization for delivery were also found in many other studies (Navaneetham & Dharmalingam, 2002; Agha & Carton, 2011; Kalule-Sabiti, Amoateng & Ngake, 2014).

In the developing countries, men play a major role in household decision-making, including utilization of health services (Beegle, Frankenberg & Thomas, 2001; Wild et al., 2010). Husband's education has also been found to have an independent effect on the use of skilled attendants (Shariff & Singh, 2002; Bashour et al., 2008). In rural areas in Bangladesh, the proportion of births attended among those whose husband had at least secondary education was twice as high as those whose husband had no schooling (40 percent versus 20 percent) (Amin, Shah & Becker, 2010).

Poor women have to overcome many barriers to deliver in a health facility with trained health professionals (UNFPA Cambodia, 2005). Family wealth is an important predictor of the use of institutional delivery (Opoku, 2009; Ir et al., 2010; Rahman et al., 2011; Tey & Lai, 2013). In Kenya, despite efforts to increase access and coverage of delivery, a high proportion of the poor still do not access skilled care even with SBAs residing in the community due to several socio-economic barriers (Mannah et al., 2014). In Ghana, an analysis of DHS data shows that while deliveries with health professionals rose from 85 percent to 90 percent between 1993 and 2003 for the richest quintile, deliveries with health professionals for the poorest quintile dropped from 25 percent to 19 percent (Opoku, 2009).

The high cost of health services and the inability of the poor to pay would pose as a serious barrier to the use of health facilities for delivery (Tey & Lai, 2013). Programs and strategies aimed at removing financial barriers in some countries have been found to be effective in increasing the utilization of delivery care services (Opoku, 2009; Ir et al., 2010).

Urban-rural differentials in health care utilization were due to the concentration of health infrastructure and personnel in urban areas (Patil, Somasundaram & Goyal, 2002). In India, urban women were four times more likely than rural women to be attended by a trained health professional during birth (Govindasamy & Ramesh, 1997). Wide urban-rural differential in skilled birth attendance was also found in Ghana (79 percent versus 33 percent) (Opoku, 2009).

Women empowerment and autonomy also affects use of health services (Shariff & Singh, 2002; Woldemicael, 2007; Fotso, Ezeh & Essendi, 2009; Woldemicael, 2009). Past studies found that women who had a say in their own health care were more likely to use a health facility for health care, including delivery (Furuta & Salway, 2006; Allendorf, 2007; Breen & Ensor, 2011; Espey & Dolata, 2011; Tey & Lai, 2013). In Yemen, underutilization of modern delivery care was attributed to women's low autonomy and status (Kempe, Alwazer & Theorell, 2011).

A survey in Nepal found that when there is consensus on the autonomous status of the wife, her autonomy is a better predictor of her use of health care services than is the case when there is a disagreement on her status. Hence, the association between women's autonomy and health care service use may be underestimated when only women's reports are considered (Allendorf, 2007). Gender inequality constrains women's access to skilled

health care, as in the case of Nepal. The strong association of women's education with health care use calls for more efforts to increase girls' schooling and alter perceptions of the value of skilled maternal health care (Furuta & Salway, 2006).

2.5.2 Barriers to the Utilization of Health Services for Delivery

There are many barriers to the use of skilled birth attendance in the developing countries. Barriers related to supply such as unavailability of services (e.g. doctor not available) and medicine, difficulty to get admission and unfriendly attitudes of service providers are seen as the main obstacles. However, many research found that demand-side barriers, often neglected by policy makers and researchers, are just as important in deterring women from accessing the health services (Ensor & Cooper, 2004). Demand-side barriers affect the poor more than those who are better off (Kempe, Alwazer & Theorell, 2011). The high costs of access can be prohibitive to the poor. Moreover, those who are less educated, from poor family and living in the rural areas tend to lack information, and face greater cultural barriers as they are also more conservative. Non-institutional delivery contributes to the high morbidity and mortality among childbearing women (Opoku, 2009).

Financial barriers are one of the most important constraints to the utilization of SBAs in developing countries. The high cost of user fee and transportation pose as a barrier for poorer women to deliver at a health facility, contributing to high mortality and neonatal mortality (Witter et al., 2007; Opoku, 2009; Tey & Lai, 2013).

Most studies on the determinants of skilled attendance focused on socio-cultural and economic accessibility variables and neglect variables of perceived benefit/need and physical accessibility. To draw valid conclusions, it is important to consider as many influential factors as possible in any analysis of delivery service use (Gabrysch & Campbell, 2009).

There is a dearth of research on ways to reduce the various barriers, especially from the demand-side. Ensor and Cooper (2004) suggested the need for robust evidence and improved methodology to evaluate the cost-effectiveness of programs. They recommended the adoption of a pragmatic policy routes that go beyond the traditional boundaries of the public health sector are required for implementing the findings.

A number of studies have dealt with the evaluation of the effectiveness of various strategies to overcome the barriers to the utilization of health services among women, especially the poor (Ensor & Cooper, 2004). Efforts in promoting family planning, for instance may help stimulate demands for maternal and child health services as vindicated by research in India (Srivastava & Bansal, 1996) and Africa (Phillips, Greene & Jackson, 1999). Community-based delivery, a strategy that takes supplies into the villages, have been found to be effective in overcoming various demand-side obstacles. Studies have shown that community delivery in Africa. The strategy may help to overcome a multiplicity of demand-side obstacles.

2.5.3 Traditional Birth Attendants (TBAs)

In many developing countries, TBAs played an important role in delivery (Ali & Howden-Chapman, 2007; Thatte et al., 2009; Oyerinde et al., 2013). With adequate training and facilitation by health department, community midwives as in the case of Pakistan, can play a vital role in reducing burden of maternal morbidity and in achieving significant gains in improving maternal and child health (Sarfraz & Hamid, 2014).

The TBAs were preferred over the health facilities as many women are unable to afford the prohibitive cost of health care services, besides the geographic inaccessibility of health facilities. Some women placed greater trust on TBAs who have vast experience and are more compassionate to them (Oyerinde et al., 2013).

In view of the important role of the TBAs, there have been initiatives to integrate them into the formal health system. A review of thirty-three articles shows that the integration of TBAs with formal health systems increases skilled birth attendance. The greatest impact is seen when TBAs integration is combined with complementary actions to overcome context-specific barriers to contact among SBAs, TBAs, and women (Byrne & Morgan, 2011). Combining western and traditional care will benefit the pregnant women and their infants' health (Ali & Howden-Chapman, 2007; Thatte et al., 2009; Ribeiro Sarmiento, 2014).

2.5.4 Discussion

The huge inequalities in the utilization of health services for delivery warrant in-depth analysis to identify the groups most in need of the service. Further, there is also a need to investigate both supply-side and demand-side barriers to the use of the health facilities. Research findings can then be used to inform policy so as to focus on user-led services rather than a 'one size fits all' approach. However, research on the correlates of and barriers to the utilization of health services among childbearing women, as well as other target groups appear to be relatively lacking.

Most of the studies reviewed were based on small sample surveys in limited geographical areas. There is a dearth of national level surveys as well as comparative studies across countries and regions. Results from these small case studies may not be representative of the national situation. The DHS conducted in over 80 countries with multiple rounds provide excellent data for cross-country comparative analysis, as well as longitudinal studies.

2.6 Research on Non-communicable Diseases (NCDs)

Research on NCDs in developing countries appears to be relatively lacking. However, with population ageing and the rapid rise of NCDs, research on NCDs by social scientists have gained momentum, as reflected in the literature review. This sub-section focuses on four aspects, namely self-rated health, the disabling impact of NCDs, multiple or co-morbidities, and socio-economic determinants and risk factors of NCDs.

2.6.1 Self-rated Health

Self-rated health is a widely used predictor of sickness, disability, the need for care and mortality (Pietiläinen et al., 2011; Ng et al., 2012; Nishi et al., 2012). Self-rated health provides a simple, integrative patient-centered assessment for evaluation of illness in the context of multiple chronic disease diagnoses (Mavaddat et al., 2014). However, empirical studies on the predictor power of self-rated health on sickness, disability and mortality are lacking in the developing countries.

Self-rated health has been found to be a strong predictor of disability (Pietiläinen et al., 2011), and mortality (Ng et al., 2012; Nishi et al., 2012). However, the gender difference in the predictive ability of sexual reproductive health was reduced for those with multiple morbidity (Nishi et al., 2012).

2.6.2 The Disabling Impact of NCDs

NCDs are the leading causes of death and disability in developed and developing countries. Disability leads to dependency, and present stressful, complex, long-term challenges to carers, with heavy social cost. The best way to reduce the burden of disability is to reduce the NCD, especially those that have debilitating effects. There is however, a lack of research on the debilitating effects of NCDs in the developing countries.

In a multi-country study, Sousa et al. (2009) found that chronic diseases accounted for two thirds of the burden of disability. Dementia contributes more to the burden of disability than limb impairment and blindness. Stroke and arthritis are also important

contributors. Musculoskeletal and cardiovascular disease, in particular back pain, peripheral vascular disease and stroke contributed most to the burden of disability because of the very high disabling impact. Arthritis and heart disease were less disabling but contributed substantially because of their high prevalence. Nonspecific lung disease (males) and diabetes (females) also contributed much to the burden of disability (Klijs et al., 2011).

Studies on the disabling impact of NCD in the developed countries show that neurological, musculoskeletal, and cardiovascular chronic disorders mainly contribute to disability in France (Palazzo et al., 2012). Hung et al. (2011) found that while multiple chronic disease is increasingly prevalent among older United States adults, the prevalence of impairment and disability, while substantial, remain stable. The decrease in functional limitation in the United States was attributed to the reduction in the disabling effects of chronic conditions (Costa, 2002). Chronic diseases, including depression, have also been found to affect quality of life and life satisfaction (Turvey et al., 2009; Mavaddat et al., 2014; Ng, Tey & Asadullah, 2017).

2.6.3 Multiple or Co-morbidity

Multiple chronic diseases is increasingly prevalent, especially among the elderly in developed and developing countries. Education and wealth were found negatively associated with the number of chronic diseases (Hung et al., 2011; Arokiasamy, Uttamacharya & Jain, 2013; Mavaddat et al., 2014). In their study, Arokiasamy, Uttamacharya and Jain (2013) found that about one in five adults in China, India, South Africa, Mexico and Ghana (the low and middle income countries) had multiple morbidity, while the figure was higher in Russia at about one in three.

Multi-morbidity is associated with self-rated health more than medical co-morbidity alone (Perruccio, Katz & Losina, 2012). The increasing number of conditions, in particular co-morbidity with stroke or heart attack result in poor self-rated health (Mavaddat et al., 2014). Co-morbidities have devastating impact on the quality of life (Lima et al., 2009).

Hypertension or raised blood pressure and diabetes mainly caused by modifiable life style factors tend to lead to other NCDs, especially chronic kidney disease (CKD) (Sherina, Rampal & Mustaqim, 2004; Ito et al., 2008; Jha, 2009; Magnusson, 2009; Howard et al., 2010; Levey et al., 2010; Soyibo, Roberts & Barton, 2011; Dzudie et al., 2012; Kim et al., 2013; Piccolo et al., 2013). In India, diabetes and hypertension are responsible for 40 percent to 50 percent of all cases of chronic renal failure (Agarwal, 2005). Findings from a population based study in Japan shows that CKD was strongly associated with the incidence of dementia, independent of age, sex, education, and other vascular risk factors (Sasaki et al., 2011).

Social inequality in the burden of NCDs is a common problem, especially in the developing countries. The lower socio-economic groups tend to have higher burden of NCDs as compared to those from higher socio-economic groups in terms of education and wealth (Hotchkiss et al., 2011; Lei, Yin & Zhao, 2012; Kano, Hotta & Prasad, 2013; Kim et al., 2013). Those from the higher socio-economic groups are more likely than those from the lower groups to go for diagnosis and treatment (Lei, Yin & Zhao, 2012).

A study of an urban population in sub-Saharan Africa found that the prevalence rate for hypertension was as high as 47.5 percent. The study also found that male gender, advanced age, parental history of hypertension, diabetes mellitus, elevated waist and elevated body mass index (BMI) were the significant predictors of hypertension (Dzudie et al., 2012).

Age, educational level, alcohol consumption and BMI are important risk factors associated with the prevalence of hypertension in Malaysia (Tee et al., 2010). Behavioral risk factors for chronic diseases involve factors relating to lifestyle habits, such as smoking, risky alcohol consumption, unhealthy diet, physical inactivity, obesity, high cholesterol and high blood pressure (Fine et al., 2004; Mayer-Foulkes, 2010; Morris et al., 2011; Durstine et al., 2013; Imboden & Probst-Hensch, 2013; Krueger et al., 2013; Leventhal, Huh & Dunton, 2014). Moderate levels of midlife occupational physical activities were found to be associated with a decreased risk of personal activities of daily living (ADL) disability in old age among white collar workers (Rydwik et al., 2013).

2.6.4 Discussion

Many studies have found self-rated health to be a strong predictor of disability (as measured by ADL and instrumental activities of daily living (IADL)) and subsequent mortality. This lends support to the use of self-rated health in the two articles on NCDs for this thesis. The findings from two articles on co-morbidities and the disabling impacts of NCDs reported in the two articles are also consistent with the findings from the vast literature on these topics.

It appears that research on the disabling effects of NCDs in the developing countries is relatively lacking, and hence our article on the debilitating effects of chronic diseases among the oldest old in China will contribute to the literature on this important aspect of public health.

There are areas of research on NCDs which are still relatively lacking. More attention should be given to the development of conceptual and theoretical frameworks for analysis, longitudinal surveys, multi-country studies and disaggregated analysis, as well as the causes and consequences of the rising trend in NCDs. There is also a need for the collection of more timely, accurate and reliable data. Efforts should also be made to ensure effective utilization of research findings.

Proximate Determinants of Fertility in Peninsular Malaysia

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Abstract

The continuing decline in fertility despite a contraction in contraceptive use in Peninsular Malaysia since the mid-1980s has triggered considerable interest in the reasons behind this phenomenon, such as increase in abortion, sterility, and out-of-wedlock pregnancy. Fertility decline has been attributed to rapid socioeconomic development, which can only influence fertility through the intermediate variables. Application of vital statistics, population census, and survey data of Peninsular Malaysia on Bongaarts's model vindicates that marriage postponement and contraceptive use are the 2 most important proximate determinants of fertility, but the effects are not uniform across the ethnic groups. For instance, the pre-dicted total fertility rate for Chinese and Malays are 2.9 and 1.6, respectively, compared with the observed level of 3.0 and 1.9. Postpartum infecundability and abortion also play a part in explaining ethnic fertility differentials. The fertility inhibiting effects of these proximate determinants have significant implications on reproductive health and future population growth.

Keywords

abortion, contraceptive use, fertility, proximate determinants, marriage

Introduction

Improved socioeconomic conditions, rising age at marriage, and widespread use of contraception have brought about rapid fertility transition in many developing countries. However, the effects of these variables on the fertility level vary widely across populations. The socioeconomic correlates of fertility have been extensively researched.¹⁻³

In most traditional societies, childbearing generally takes place within marriage. Hence, the timing of marriage is closely associated with fertility level. Consequent upon educational improvement and social changes, age at marriage has been rising steadily.⁴ The pros and cons of postponement of marriage and childbearing on health and happiness are still being debated.

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Following the launching of family planning programs in many developing countries in the 1960s and 1970s, contraceptive use has expanded significantly across populations. The impact of the programs on contraceptive use, which in turn result in fertility decline, is well documented.⁵⁻⁷

Davis and Blake⁸ were the first to provide a systematic classification of 11 intermediate or proximate determinants through which social, economic, and cultural factors must operate to influence fertility. This analytical framework gained popularity after Bongaarts formulated a model that incorporates 4 quantifiable proximate determinants that explain 96% of the variance in fertility across populations. These 4 proximate determinants are (a) proportion married among women in the reproductive age group, (b) contraceptive use, (c) induced abortion, and (d) breast-feeding.^{9,10} The availability of data from the World Fertility Survey and the Demographic and Health Surveys has facilitated fertility analysis using this framework. By 1995, more than 100 publications have appeared describing the applications of Bongaarts's model to different populations and settings.¹¹

Fertility Trends in Malaysia and Reasons for This Study

In 2000, about 80% of the population of Malaysia lived in Peninsular Malaysia, 11% in Sabah and 9% in Sarawak. In Peninsular Malaysia, the Malays make up about 60% of the population, Chinese 26.4%, Indians 9.1%, and others 0.8%. The population of Sabah and Sarawak is characterized by a greater diversity of indigenous population. This article focuses on the 3 main ethnic groups in Peninsular Malaysia where the demographic data are of better quality.

Fertility transition in Peninsular Malaysia began even before the launching of the National Family Planning Program in 1966. In 1960, Indians had the highest total fertility rate (TFR; TFR is defined as the average number of children that would be born to a woman over her lifetime if she were to experience the exact current age-specific fertility rates [ASFRs] through her lifetime) of 7.3 children per woman, followed by Chinese (6.3) and Malays (5.8). However, the pace of fertility decline differed widely by ethnic group, such that the fertility of the Malays has always been higher than that of the Chinese and Indians since 1965 (Figure 1).

Between 1966 and 1985, the TFR in Peninsular Malaysia declined from 5.7 in 1965 to 3.6 in 1985 amidst a sharp rise in contraceptive prevalence rate (CPR; CPR is defined as the percentage of currently married women using any contraceptive method) from 8% to 50%. Over the next 2 decades, the contraceptive prevalence rate stagnated and even showed a decline, but the total fertility rate continued to decline appreciably to 3.0 in 2000, 2.5 in 2005 and further to 2.3 in 2008.

Based on the regression equation derived from a study by Tsui,¹² where $TFR = 7.27 - 0.07 \text{ CPR}$, the expected TFR of Peninsular Malaysia would be 3.8. The observed value of 2.4 is short of the expected value by 1.4, given a CPR of about 50%. Discrepancies in the relationship between TFR and CPR have been found in other parts of the world.¹³⁻¹⁵ Nevertheless, the lower than expected TFR has given rise to speculations that abortion and sterility are on the rise, accompanied by a growing interest to ascertain the reasons behind the anomaly.

Past research in Malaysia has dealt mainly with the socioeconomic determinants and ethnic fertility differentials.¹⁶⁻¹⁸ Despite the importance of the intermediate variables in explaining fertility differentials, there is a dearth of research on this topic. A report on the direct and indirect determinants based on the 1984 Malaysian Population and Family Survey was prepared by Tey et al.¹⁹ Since then, there have been significant changes in the level of fertility and other proximate determinants of fertility, including a decline in contraceptive use. An updated analysis on the proximate determinants is very much needed to explain the reasons behind ethnic fertility differentials and to unravel the puzzles of continuing fertility decline despite the stagnation of contraceptive use.

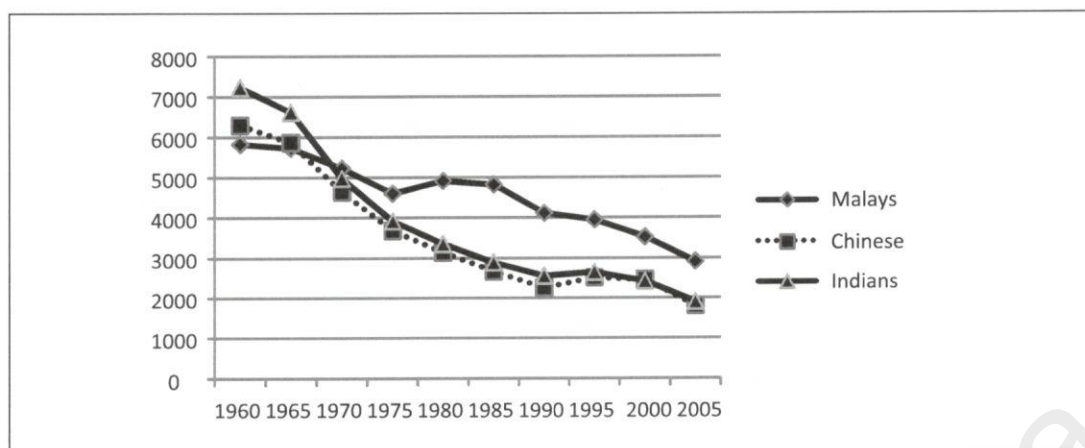


Figure 1. Total fertility rate by ethnicity: Peninsular Malaysia, 1960-2005

This article examines the relative contribution of the main proximate determinants of fertility, based on the model proposed by Bongaart.^{9,10} It also attempts to explain the ethnic fertility differentials from the perspective of intermediate variables.

Methods

This article is based on the analysis of data from the 2000 Population Census,²⁰ the 2004 Vital Statistics from the Department of Statistics,²¹ and the 2004 Malaysian Population and Family Survey (MPFS), conducted by the National Population and Family Development Board.²² Malaysia has an efficient vital registration system dating back to the 1960s. Registration of births is virtually complete. The annual vital statistics reports provide data on TFR and ASFR by ethnicity and state. The 2004 MPFS covered a representative sample for Peninsular Malaysia, Sabah, and Sarawak.

Bongaarts's model is used to estimate the indices of the 4 main proximate determinants that explain practically all the variance in fertility level across populations.^{9,10} In this model, the TFR is the product of 4 indices measuring their fertility-inhibiting effect and the total fecundity rate (TF), as follows:

$$\text{TFR} = C_m \times C_c \times C_a \times C_i \times \text{TF},$$

where, C_m is the index of proportion married, C_c is the index of contraception, C_a is the index of induced abortion, and C_i is the index of postpartum infecundability.

Each of the indices ranges from 0 to 1, with smaller values indicating greater effects, and 1 indicating no inhibiting effect. The total fecundity rate, with a mean value of 15.3 children per woman across populations, is the average number of live births born to women who during their reproductive period remain married, do not use any contraception, do not have any induced abortion, and do not breastfeed their children.^{9,10}

C_m is derived from the 2000 Population Census and 2004 Vital Statistics. The other 3 indices C_c , C_i , and C_a are estimated using the 2004 MPFS.

The index of marriage (C_m) is used to assess the fertility inhibiting effects of marriage pattern. C_m takes the value of 1 when all women of reproductive age are married, and 0 when none is married. Hence, the smaller the value, the larger is the impact of this variable on fertility. The index of marriage is computed as follows:

$$C_m = \Sigma m(a)g(a)/\Sigma g(a) = \text{TFR}/\text{TM},$$

where $m(a)$ is the age-specific proportion married, $g(a)$ is the age-specific marital fertility rates, and TM is the total marital fertility rate.

The age-specific marital fertility rates are obtained by dividing the ASFR by proportion married for each age group. The total marital fertility rate is obtained by summing up the age specific marital fertility rates.

The index of contraception is computed as follows:

$$C_c = 1 - 1.18 \times u \times e,$$

where u is the prevalence of current contraceptive use among currently married women, and e is the average use-effectiveness of contraception.

The 2004 MPFS included a full pregnancy history in which women were asked the outcome and duration of each pregnancy. Pregnancies that ended before 28 weeks of gestation were classified as early pregnancy loss or abortion, which includes spontaneous and induced abortion. Using 1988 Ghana Demographic and Health Survey Data, Blanc and Grey¹³ calculated a total pregnancy loss rate for the 5-year period prior to the survey. Their estimated total abortion rate of 0.65 per women for Ghana, was obtained by counting all early pregnancy losses instead of live births in the numerator, and it is analogous to the total fertility rate. As information on the date of termination of pregnancy is not available in the 2004 MPFS, a cohort rate based on the total number of early pregnancy losses (ie, all pregnancies that ended before 28 weeks) is estimated for each married woman aged 35 years and older. The index of abortion (C_a) is computed as follows:

$$C_a = \text{TFR}/[\text{TFR} + 0.4 \times (1 + u) \times \text{TA}],$$

where u is the contraceptive prevalence rate and TA is the total abortion rate among married women.

In the 2004 MPFS, women who had at least one child aged less than 6 years old were asked on their duration of breastfeeding the youngest child. Data show that the percentage that had breastfed their youngest child was highest among Malays (93%), and lowest among Chinese (52.5%), with Indians in between (83.1%). At the time of the survey, about one third of Malay respondents who breastfed their youngest child were continuing, whereas only about 4% of Chinese and 8% of Indian respondents were still breastfeeding. Hence, the problem of censoring and truncation in estimating the mean breastfeeding duration is much more serious among Malays as compared with the other 2 ethnic groups.

The index of postpartum infecundability is computed as follows:

$$C_i = 20/(18.5 + i),$$

where $i = 1.753 \exp(0.1396 \times B - 0.001872 \times B^2)$; and B is the mean duration of breastfeeding.

Results

The Fertility Inhibiting Effects of Delayed and Nonmarriage

Age at marriage among Malaysian men and women has been rising steadily over the years. The singulate mean age at marriage for Malaysian women increased from 22 years in 1970 to 25.1 years in 2000, whereas that of the men increased from 25.5 to 28.6 years during

Table 1. Proportion Married Among Women, Age-Specific Fertility Rate, and Age-Specific Marital Fertility Rate by Ethnic Groups: Peninsular Malaysia, 2005

Age Group (Years)	Proportion Married Among Women			Age-Specific Fertility Rate			Age-Specific Marital Fertility Rate		
	Malays	Chinese	Indians	Malays	Chinese	Indians	Malays	Chinese	Indians
15–19	0.02	0.02	0.034	0.045	0.045	0.06	2.25	2.25	1.76
20–24	0.29	0.18	0.29	0.38	0.275	0.385	1.31	1.52	1.33
25–29	0.75	0.56	0.67	0.95	0.645	0.755	1.27	1.15	1.13
30–34	0.86	0.81	0.83	0.855	0.63	0.570	0.99	0.77	0.69
35–39	0.89	0.88	0.86	0.54	0.265	0.265	0.61	0.30	0.31
40–44	0.88	0.88	0.84	0.195	0.055	0.065	0.22	0.06	0.08
45–49	0.88	0.88	0.81	0.02	0.005	0.005	0.023	0.00	0.01
					TMFR		6.67	6.05	5.30
					TFR		3.0	1.92	2.11
					C_m		0.45	0.32	0.40

Abbreviations: TMFR, total marital fertility rate; TFR, total fertility rate; C_m , index of proportion married.

the same period. Wide variations in age at marriage can be observed across the ethnic groups. In 2000, the singulate mean age of marriage of Malay women was 24.8 years as compared with 27.0 years for Chinese and 25.4 years for Indians. More and more women are also remaining single. The proportion never married among those aged 30 to 34 years increased from 6% in 1970 to 13% in 2000. Later marriage is a result of rising educational level and increased participation of women in the labor force. The educational level has a greater effect on marriage postponement among Chinese as compared with Malays and Indians. In 2000, the singulate mean age at marriage for tertiary educated Chinese women was more than 5 years later than those with primary schooling (29.1 vs 23.8 years). The tertiary educated Malay and Indian women married only about 2.4 years and 1.3 years later than their counterparts with primary schooling (25.5 vs 23.1 years for Malays and 24.1 vs 22.8 years for Indians). At age 30 to 34 years, almost 30% of tertiary educated Chinese women were still unmarried.²³ Increased labor force participation among women has given them more options than marriage. With economic independence, women may choose not to marry to pursue their career and enjoy greater freedom.

Table 1 shows that for most age groups, a higher proportion of Malay women were married as compared with Chinese and Indians. Given that childbearing outside of wedlock is still relatively rare in Malaysia, variation in the timing of marriage among different ethnic groups has resulted in fertility differentials.

The estimated C_m values is lowest among Chinese and highest among Malays, indicating that the fertility-inhibiting effect of marriage postponement is most pronounced among Chinese and smallest among Malays (Table 1).

The Fertility-Inhibiting Effects of Contraceptive Use

Studies have found a strong relationship between CPR and TFR across populations. Regression estimates show that a 15% rise in CPR will result in a reduction of one child per woman.^{12,24} Although the continuing fertility decline in Peninsular Malaysia despite a reduction in CPR seems incongruent, the fertility inhibiting effect of contraceptive use across subgroups of the population in Malaysia is clearly demonstrated. The Chinese have the highest CPR and the lowest TFR. On the other hand, Malays have the lowest CPR and the highest TFR. The CPR

Table 2. Contraceptive Prevalence Rate, Use Effectiveness, and Index for Contraception, by Year and Ethnic Group

Ethnic Group	Contraceptive Prevalence Rate				Use Effectiveness	Estimated C_c
	1974	1984	1994	2004		
Malays	26	41	46	39	0.83	0.62
Chinese	55	64	73	64	0.83	0.38
Indians	49	66	64	51	0.83	0.50
All	36	52	55	48	0.83	0.53

increased rather appreciably between 1974 and 1984. However, since the mid-1980s when the government announced the new population policy to have a population of 70 million by 2100, the CPR had increased marginally during the next decade, and decreased in the more recent period (see Table 2). With modernization, couples are expected to avail themselves of family planning services and supplies that are widely available. Hence, the dip in CPR is rather puzzling, especially when the TFR has continued to decline. Applying the 2004 MPFS data to Bongaarts's model, the estimated C_c is 0.53 for Peninsular Malaysia. This ranges from 0.38 for Chinese, to 0.50 for Indians, to 0.62 for Malays.

In 2004, the contraceptive prevalence was estimated at 39% for Malays, 64% for Chinese, and 51% for Indians.²² A rather sizable proportion of them use traditional methods, especially the rhythm method. Table 3 presents the method mix and use effectiveness by ethnic groups.

The Fertility-Inhibiting Effects of Abortion

Under Malaysian law, abortion may be carried out to save the life of the woman and to preserve her physical and mental health. The preservation of mental health covers rape, incest, or fetal impairment.²⁵ The public, including some doctors are unaware of these conditions for abortion. In 2007, the Reproductive Rights Advocacy Alliance of Malaysia was formed with the objective to inform, educate, and advocate on reproductive health issues, including abortion.²⁶

Of late, the increased incidence of youth sexuality, out-of-wedlock pregnancies, and abandoned babies has been highlighted in the media. There are no official data on induced abortion. However, some commentators have speculated that abortion is on the rise. To quantify the fertility-inhibiting effects of abortion, it would be necessary to estimate indirectly the total abortion rate. Table 4 summarizes the ethnic differentials in the total abortion rate, the proportion of pregnancies ending in abortion and the index of abortion.

A study by Gilda et al.²⁷ concluded that in Southeast Asia about 27% of pregnancies ended in abortion (11% safe and 16% unsafe). A regression analysis by Westoff²⁸ put the total abortion rate for Southeast Asia at 1.1, and this corresponds quite closely with the estimate of 1.2 by the World Health Organization. It appears that the early pregnancy loss (14% of total pregnancy) and the total abortion rate of 0.41 based on the 2004 MPFS probably represent an underestimate.

The Fertility-Inhibiting Effects of Postpartum Infecundability

The estimated duration of breastfeeding among those who had stopped is 12.5 months for Malays, 1.7 months for Chinese, and 4.6 months for Indians. Taking into account the age of child among those who were still breastfeeding, the mean breastfeeding duration was adjusted to 14 months

Table 3. Method Mix and Use Effectiveness by Ethnic Groups

	Method Effectiveness	Percentage Distribution by Method		
		Malays	Chinese	Indians
Condom	0.81	4.5	29.9	7.4
Female sterilization	1.00	6.1	18.8	22.3
Injectable	1.00	3.5	1.4	1.7
Intrauterine device	0.96	8.2	7.7	10.9
Norplant	1.00	1.1	0.5	0.0
Male sterilization	1.00	0.1	0.3	0.0
Pill	0.92	41.9	9.1	16.6
Traditional	0.60	20.7	8.7	20.5
Rhythm	0.70	13.9	23.4	20.0
Vagina tablet	0.80	0.0	0.2	0.6
Total		100	100	100
Use effectiveness		0.83	0.83	0.83

Table 4. Total Fertility Rate, Total Abortion Rate, Percentage of Pregnancies Ending in Abortion, and Index for Abortion by Ethnic Groups

	Total Fertility Rate	Total Abortion Rate	Percentage of Pregnancies Ended in Abortion	C_a
All	2.5	0.41	14	0.91
Malays	2.9	0.38	12	0.93
Chinese	1.8	0.40	18	0.87
Indians	1.9	0.45	19	0.87

among Malays, 2 months among Chinese, and 6 months among Indians. The index of postpartum infecundability (C_i) estimated using Bongaarts's formula is 0.74 for Malays, 0.96 for Chinese, and 0.89 for Indians.

Summary of the Fertility-Inhibiting Effects of the Main Proximate Determinants

Table 5 summarizes the fertility-inhibiting effects of the proximate determinants for the 3 main ethnic groups in Peninsular Malaysia. The expected TFR is obtained by multiplying the total fecundity rate of 15.3 by the indices. For instance, the expected TFR for the Malays is $15.3 \times 0.45 \times 0.62 \times 0.93 \times 0.74$. The value of 15.3 is the average TF value for a large number of populations in Bongaarts's studies^{9,10} and hence is used in this analysis.

Discussion

In previous studies, Bongaarts found that in population with a TFR of less than 3, C_m was in the range of 0.4 to 0.65, C_c in the range of 0.22 to 0.45, C_a in the range of 0.5 to 1.0, and C_i in the range of 0.9 to 1.0.⁹ With some exceptions, our estimates are within these ranges. The low C_m value among the Chinese can be explained by the prevalence of nonmarriage and delayed marriage. The high C_c values for the Malays, and to a lesser extent the Indians, is reflective of their low level of CPR. The relatively low C_i value among the Malays can be explained by the prevalence of breastfeeding among them.

Table 5. Summary of Indices of the Proximate Determinants of Fertility by Ethnic Group^a

	Ethnic Group		
	Malays	Chinese	Indians
C_m	0.45	0.32	0.40
C_c	0.62	0.38	0.5
C_a	0.93	0.87	0.87
C_i	0.74	0.96	0.89
Expected total fertility rate (TFR) based on total fecundity rate (TF) of 15.3	2.9	1.6	2.3
Actual TFR	3.0	1.9	2.1
Difference between expected and actual TFR	-0.1	-0.3	+0.2
Percentage difference	-3.3	-15	+9

^a Data from Tables 1 to 3.

Overall, delayed marriage is by far the most important factor in reducing the fertility level. However, the widespread use of contraception among Chinese is just as important as delayed marriage in explaining their low level of fertility. These 2 factors account for a large part of the difference between the fecundity rate and TFR. Whereas the abortion index is lower among Chinese and Indians as compared with Malays, the reverse is true for the index of postpartum infecundability.

The expected TFRs, obtained by multiplying the assumed TF value of 15.3 as proposed by Bongaarts, correspond quite closely with that of the observed TFR for Malays and Indians. The higher than expected TFR among the Chinese could be attributed to out-of-wedlock births, as cohabitation has become more common. On the other hand, the lower than expected TFR among Indians could be due to some underreporting of CPR as the 2004 survey showed a significant drop in the level of contraceptive use since 1994.

The accuracy and reliability of the estimated fertility-inhibiting effects of the proximate determinants of fertility depend to a large extent on the quality of the data used in the computation. The assumed TF value of 15.3 is a hypothetical figure, and the value of TF is found to vary between 13 and 17.¹⁰ The fertility-inhibiting effects shown in this article should be taken as indicative of the relative contribution of each of these factors in explaining the fertility levels and differentials. Moreover, part of the inconsistency between the CPR and TFR may be explained by the temporal distortion of TFR. Being a period measure, the TFR is temporarily depressed, and hence underestimated, by a rise in the mean age of childbearing. There is a distinct possibility for the TFR to reverse its downward trend as the temporal effect is about to run its course.²⁹⁻³¹

Delayed marriage results in smaller families and hence lower dependency and allows women more freedom to pursue their career and enhance their individual and family well-being. However, postponing the age at marriage to late 20s or even early 30s may result in greater risk of childlessness and adverse effects on maternal and child health.

The index of abortion was not estimated in a previous study by Tey et al.¹⁹ However, the index of postpartum infecundability remains largely unchanged for Chinese and Indians but that for Malays was estimated to decrease slightly to 0.74 from 0.80 previously. Given the health benefits of breastfeeding to infants, campaigns for breastfeeding should be stepped up, and facilities enhanced to encourage more women to breastfeed their babies.

The estimated abortion rate in this study, which includes both spontaneous and induced abortion, is much lower than most other estimates for developing countries. This could be due to underreporting as it is a taboo subject. According to the World Health Organization, about 1

in 5 pregnancies worldwide end in abortion, and for every 1000 women of childbearing age (15 to 44 years), 29 were estimated to have had an induced abortion in 2003.

With rising age at marriage, the period of exposure to sex outside marriage among the young people has become longer. Abortion is probably on the rise among the unmarried youths who are not provided with family planning services. The increased incidence of baby dumping and out-of-wedlock pregnancies reported in the media, and hence the possibility of an increase in abortion, has prompted the government to adopt the Social and Reproductive Health Education Policy and to consider seriously the introduction of sex education in schools. These programs and strategies are designed to educate an increasing number of unmarried persons on the need to stay away from sex and to behave responsibly for their own reproductive health.

The model used in this study incorporates only 4 proximate determinants. Primary sterility or infertility is probably on the rise in Malaysia, as in other parts of the world. Serajeldin et al.³² found that about one fourth of Iranian couples experience primary infertility at some points in their lives and that 3.4% suffer from this problem at any time. According to Bill Ledger, an in vitro fertilization specialist, 1 in 3 couples in Europe could suffer from infertility problems in 10 years' time, up from the current level of 1 in 7.³³ The *New Sunday Times* reported that as many as half of those who visit gynecological specialists were asking for treatment to help them conceive.³⁴ In view of the likely increase in primary sterility, the index of primary sterility (C_p) will have to be incorporated into the model. But the data on infertility must first be collected through survey and laboratory tests.

The fertility-inhibiting effects of marriage have increased rather substantially since the mid-1980s owing to the rising age at marriage. In 1985, the C_m was 0.68 for Malays, 0.58 for Chinese, and 0.61 for Indians¹⁹; however, these decreased to 0.45, 0.32, and 0.40, respectively, for each of the ethnic groups in 2004. Reflecting the stagnation in the CPR over the 2 decades, the index of contraception C_c has remained largely unchanged (ie, from 0.67 to 0.62 for Malays, remained at 0.38 for Chinese, and 0.40 to 0.50 for Indians). Hence, the fertility decline that has taken place in the past 2 decades or so was largely brought about by the changing marriage pattern, and this is true for all ethnic groups. The much smaller fertility-inhibiting effects of these 2 proximate determinants for Malays as compared with the other 2 ethnic groups result in the rather wide ethnic fertility differentials. This gap is likely to remain as Malays are expected to enter marriage earlier and to be less likely to use a contraceptive method in the foreseeable future.

The CPR is relatively low in Peninsular Malaysia for its level of development. Concerns on the high level of unmet need for contraception have been raised in several forums. There is a need to revitalize family planning to enhance the reproductive rights and health of women, especially those who are underserved. In view of the stagnation of CPR, there is a need to adopt new strategies to reduce unmet need for contraception to prevent unwanted pregnancies, which will result in a reduction in induced abortion.³⁵

Conclusion

Bongaarts's model predicted rather accurately the total fertility rate for Malays and Indians, and to a lesser extent for the Chinese in Peninsular Malaysia. The difference between the expected and actual TFR ranges from 3.3% among the Malays, 9% among the Indians, and 15% among the Chinese. As alluded to above, the higher than expected TFR among the Chinese could be brought about by the increase in out-of-wedlock births as cohabitation has become more prevalent. More up-to-date and accurate data on abortion and sterility needs to be collected for further refinement of the model.

For all 3 ethnic groups, the index of marriage is lower than that of contraception. Hence, marriage postponement explains a large part of the inconsistency of the fertility level given the contraceptive prevalence rate. Reflecting the stagnation of contraceptive prevalence rate, the index of contraception has not changed much since 1985. Younger age at marriage and lower contraceptive use among the Malays as compared with the non-Malays account for much of the ethnic fertility differentials in Peninsular Malaysia. Whereas the fertility of the Chinese and Indians has dipped below the replacement level, Malay fertility is still in the midst of transition. This will result in significant shift in the ethnic composition of the population.

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References

1. Aminul Haque M, Sayem AM. Socioeconomic determinants of age at first birth in rural areas of Bangladesh. *Asia Pac J Public Health*. 2009;21:104-111.
2. Mauldin WP, Berelson B, Sykes Z. Conditions of fertility decline in developing countries 1965-1975. *Stud Family Plann*. 1978;9:90-147.
3. Renata F, Tienda M. What's behind racial and ethnic fertility differentials? *Popul Dev Rev*. 1996;22(Suppl.):109-133.
4. Jones G. Delayed marriage and very low fertility in Pacific Asia. *Popul Dev Rev*. 2007;33:453-478.
5. Bongaarts J, Mauldin WP, Phillips JF. The demographic impact of family planning programs on fertility. *Stud Family Plann*. 1990;21:299-310.
6. Gu B, Wang F, Guo Z, Zhang E. China's local and national fertility policies at the end of the twentieth century. *Popul Dev Rev*. 2007;33:129-147.
7. Jones G, Leete R. Asia's family planning programs as low fertility is attained. *Stud Family Plann*. 2003;33:114-126.
8. Davis K, Blake J. Social structure and fertility: an analytic framework. *Econ Dev Cult Change*. 1956;4:211-235.
9. Bongaarts J. A framework for analyzing the proximate determinants of fertility. *Popul Dev Rev*. 1978;4:105-132.
10. Bongaarts J. The fertility-inhibiting effects of the intermediate fertility variables. *Stud Family Plann*. 1982;13:179-189.
11. Stover J. Revising the proximate determinants of fertility framework: what have we learned in the past 20 years? *Stud Family Plann*. 1998;29:255-267.
12. Tsui A. Population policies, family planning programs, and fertility: the record. In: Bulatao R, Casterline J, eds. *Global Fertility Transition*. New York, NY: Population Council; 2001:184-204.
13. Blanc AK, Grey S. *Greater Than Expected Fertility Decline in Ghana: An Examination of the Evidence*. Calverton, MD: Macro International and National Population Council Secretariat, Ghana; 2000.
14. Sian LC, Ian DI. When fertility seems too high for contraceptive prevalence: an analysis of Northeast Brazil. *Int Family Plann Perspect*. 1995;21:58-63.
15. Unnati RS, Bairagi R. Inconsistencies in the relationship between contraceptive use and fertility in Bangladesh. *Int Family Plann Perspect*. 2007;33:31-37.
16. Govindasamy P, DaVanzo J. Ethnicity and fertility differentials in Peninsular Malaysia: do policies matter? *Popul Dev Rev*. 1992;18:243-267.
17. Leete R. Dual fertility trends in Malaysia's multiethnic society. *Int Family Plann Perspect*. 1989;15:58-65.

18. Tey NP. Fertility trends and differentials in Peninsular Malaysia: four decades of change. In: Ariffin J, ed. *Women in Development: Two Decades of Change*. Kuala Lumpur, Malaysia: MPH; 2009:293-310.
19. Tey NP, Tan BA, Tan PC, Kwok KK. *Direct and Indirect Determinants of Fertility in Peninsular Malaysia*. Kuala Lumpur, Malaysia: National Population and Family Development Board; 1988.
20. Department of Statistics Malaysia. *Population and Housing Census of Malaysia: Education and Social Characteristics of the Population*. Putrajaya, Malaysia: Department of Statistics; 2002.
21. Department of Statistics Malaysia. *Vital Statistics Malaysia Special Edition*. Putrajaya, Malaysia: Department of Statistics; 2006.
22. National Population and Family Development Board Malaysia. *Report of the 2004 Malaysian Population and Family Survey*. Kuala Lumpur, Malaysia: National Population and Family Development Board; 2008.
23. Tey NP. Trends in delayed and non-marriage in Peninsular Malaysia. *Asia Popul Stud*. 2007;3:243-261.
24. Ross JA, Frankenberg EE. *Findings From Two Decades of Family Planning Research*. New York, NY: The Population Council; 1993.
25. Asia Safe Abortion Partnership. Country profile: Malaysia. <http://www.asap-asia.org/country-profile-malaysia.htm>. Accessed August 18, 2010.
26. Reproductive Rights Advocacy Alliance of Malaysia. Website <http://towncriermy.hypermart.net/rraam/about.html>. Accessed August 24, 2010.
27. Gilda S, Henshaw S, Susheela S, Elizabeth A, Iqbal HS. Induced abortion: estimated rates and trends worldwide. *Lancet*. 2007;370:1338-1345.
28. Westoff CF. *A New Approach to Estimating Abortion Rates*. DHS Analytical Studies 13. Calverton, MD: Macro International; 2008.
29. Bongaarts J. Fertility, and reproductive preferences in post-transitional societies. *Popul Dev Rev*. 2001;27(Suppl.):260-281.
30. Bongaarts J. The end of the fertility transition in the developed world. *Popul Dev Rev*. 2002;28:419-443.
31. Morgan SP, Guo Z, Hayford SR. China's below-replacement fertility: recent trends and future prospects. *Popul Dev Rev*. 2009;35:605-629.
32. Serajeldin V, Ardalan A, Mohammad K. Prevalence of primary infertility in the Islamic Republic of Iran in 2004-2005. *Asia Pac J Public Health*. 2009;21:287-293.
33. Fielder C, King C. *Sexual Paradox: Complementarity, Reproductive Conflict and Human Emergence*. London; 2004. <http://www.dhushara.com/paradox.htm/reprod.htm>. Accessed August 18, 2010.
34. Majawat E. Malaysian facing fertility crisis. *New Sunday Times*. July 12, 2009.
35. Bongaarts J, Westoff CF. The potential role of contraception in reducing abortion. *Stud Family Plann*. 2000;31:193-202.

Medical Students' Attitudes toward Abortion Education: Malaysian Perspective

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Abstract

Background: Abortion is a serious public health issue, and it poses high risks to the health and life of women. Yet safe abortion services are not readily available because few doctors are trained to provide such services. Many doctors are unaware of laws pertaining to abortion. This article reports survey findings on Malaysian medical students' attitudes toward abortion education and presents a case for including abortion education in medical schools.

Methods and Results: A survey on knowledge of and attitudes toward abortion among medical students was conducted in two public universities and a private university in Malaysia in 2011. A total of 1,060 students returned the completed questionnaires. The survey covered about 90% of medical students in Years 1, 3, and 5 in the three universities. About 90% of the students wanted more training on the general knowledge and legal aspects of abortion, and pre-and post-abortion counseling. Overall, 75.9% and 81.0% of the students were in favor of including in medical education the training on surgical abortion techniques and medical abortion, respectively. Only 2.4% and 1.7% were opposed to the inclusion of training of these two methods in the curriculum. The remaining respondents were neutral in their stand. Desire for more abortion education was associated with students' pro-choice index, their intention to provide abortion services in future practice, and year of study. However, students' attitudes toward abortion were not significantly associated with gender, type of university, or ethnicity.

Conclusions: Most students wanted more training on abortion. Some students also expressed their intention to provide abortion counseling and services in their future practice. Their desire for more training on abortion should be taken into account in the new curriculum. Abortion education is an important step towards making available safe abortion services to enable women to exercise their reproductive rights.

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Introduction

The World Health Organization (WHO) estimated that there were about 42 million abortions globally in 2008, of which half were unsafe abortions. Almost all of the unsafe abortions were in developing countries. Unsafe or clandestine abortions were frequently performed by providers without the necessary skills and in an environment that did not conform to the minimum medical standards. In some instances, abortions were self-induced. Unsafe abortions imposed heavy economic and health burdens on women and society [1,2].

Unsafe abortion rate is the number of unsafe abortions per 1,000 women aged 15–44 years in a year, and is used to measure the level of unsafe abortion in a population. Unsafe abortion ratio is the number of unsafe abortions per 100 live births (as a proxy for pregnancies) in a year, and is a measure of the likelihood that a pregnancy will end in unsafe abortion rather than in a live birth [1]. Globally, the unsafe abortion rate in 2008 was about 14 per

1,000 women aged 15–44, and for every 100 live births there were 16 unsafe abortions. The incidence of unsafe abortion varied widely across regions, countries and within countries. The highest observed unsafe abortion ratios were in developing countries with incomplete estimates [3]. The unsafe abortion rate and abortion ratio was relatively high in Southeast Asia, with an estimated rate of 22 per thousand women and 28 per 100 live births respectively [1].

Information on the incidence of abortion in Malaysia is not readily available. However, there are good reasons to believe that abortion is on the rise because the fertility level has been declining from 3.5 children per woman in 1985 to about 2.3 today, despite the stagnation of contraceptive prevalence rate at about 50% for all methods and 33% for modern methods since the mid 1980s [4].

The abortion law in Malaysia has become relatively liberal after it was amended in 1989. It allows abortion in order to preserve the physical and mental health of women, in addition to saving the life

of pregnant woman which used to be the only legal basis for abortion [5]. Under the amended law, third-party authorization by a medical professional is still required. The public, including some medical professionals are unaware of this law. Due to the lack of knowledge of abortion law/procedures, and a poor understanding of women's need, many doctors do not provide abortion services [6,7]. Medical doctors also lack training on abortion counseling and service as medical schools in Malaysia have given little attention to abortion education [8].

To our knowledge, medical curriculum in Malaysian universities has been designed without incorporating students' opinion. In Malaysia, apart from a study on medical students' perception of biostatistics and epidemiology module [9], no study has been conducted to obtain student feedback on the curriculum. Studies on students' perception on abortion education in North America found that students played an active role in advocating abortion education in medical schools [10–14]. A review of the literature shows that no such study has been done in Malaysia and other developing countries.

In view of the growing demand for safe abortion and the dearth of research on this topic, a survey was conducted to find out medical students' knowledge of and attitudes toward abortion, including abortion education. It is hoped that the dissemination of the findings from this study will provide a case for the inclusion of more abortion education in the medical schools in Malaysia and other developing countries, as a first step towards making safe abortion more readily available to women.

Materials and Methods

Ethics Statement

The proposal to conduct the survey was endorsed by the Medical Ethics Committee, University of Malaya Medical Centre, which specifically approved this study in writing. Permission was sought from the deans of the three medical schools, and informed consent was obtained from all respondents before the questionnaires were administered.

Study Setting

Malaysia is a multi-ethnic country in Southeast Asia. Out of a total population of 28.3 million in 2010, 91.8% were Malaysian citizens and 8.2% were non-citizens. Among the citizens, the Malays made up 55.5%, Chinese 25.6%, Indians 7.3%, other ethnic groups 13.5% [15]. Today about 71% of the population lives in the urban areas, as compared to 28% in 1970. Malaysia has achieved remarkable socio-economic progress. It is classified as an upper middle income country by the World Bank, and a high human development index (HDI) country by the United Nations. The gross enrolment rate for primary, secondary and tertiary education is about 95%, 70% and 38% respectively [16]. A report of the Ministry of Higher Education put the total enrolment in public and private institutions of higher learning at 921,979 in 2009, with 202,203 graduating in that year [17]. In Malaysia, medical education is a 5-year undergraduate program. Upon completing the 5-year program, students are awarded the Bachelor of Medicine, Bachelor of Surgery (MBBS). Some proceed to pursue post graduate courses with specialization in a particular field. Currently, there are 33 medical schools in Malaysia, and around 4,000 medical students are expected to graduate with MBBS degree annually.

Study Design and Data Collection

The survey was planned to cover two public universities and two private universities out of a total of 33 medical schools in

Malaysia. The sampling design for this survey used a combination of stratified random sampling and single stage cluster sampling. The universities were stratified according to public and private universities, and two universities were randomly selected from each stratum. Under the one-stage sampling scheme, all Years 1, 3 and 5 medical students in the selected universities would be interviewed. The management of one private university did not give permission for the survey to be conducted, and no replacement was made. The prerequisites for admission of students are rather similar for all the universities as the entry criteria are being regulated by the Ministry of Higher Education. Hence, students from the three universities would be fairly representative of the study population.

The survey was carried out from March through May 2011 to cover all the Years 1, 3 and 5 medical students in the two selected public universities. However, the survey in the private university was confined to all Years 3 and 5 medical students, as Year 1 students were attending classes in a foreign campus. Research team members explained the objectives of the survey before distributing the questionnaires to the students for self administration during lecture sessions of core courses. A total of 1,060 students returned the questionnaires, representing a response rate of about 90%. Of the 1,060 students who returned the completed questionnaire, 69 did not answer questions pertaining to abortion education or pro-choice or intention to provide abortion services, and were excluded from the analysis.

The Survey Instrument

The questionnaire was designed in consultation with key personnel from the Ministry of Health, the Reproductive Rights Advocacy Alliance of Malaysia (RRAAM) and the universities, to collect data on students' knowledge of and attitudes toward induced abortion, and related reproductive health services including contraceptive use. The draft questionnaire was pre-tested on 30 Year 2 medical students in one of the public universities selected for the main survey.

The questionnaire consisted of 26 items. These items included students' knowledge of abortion and reproductive health, attitudes toward abortion and abortion education (general knowledge, surgical and medical abortion, legal aspects of abortion, and pre- and post-abortion counseling), type of university (public and private), year of study, gender, ethnicity, and intention to provide abortion services in future practice. The questionnaire also included agreement or disagreement on 12 Likert scale statements on various conditions for abortion, such as on the grounds of rape, risk to women's health and life, their rights and socio-economic considerations, from 1 for those who disagreed strongly (not pro-choice) to 5 for those who agreed strongly (pro-choice).

Statistical Analysis

All data were entered into the computer and checked for data entry errors, missing data and inconsistencies. Data were analyzed using SPSS for Windows version 19. A pro-choice index was created by summing the responses to the 12 statements, with a Cronbach's Alpha value of 0.8581. The index was further regrouped into 3 main categories: below 29, 29–36, and 37+. Respondent's feedback to each of the six questions relating to their intention to provide abortion counseling, referrals and services were recoded as 2 if the answer was "Yes", 1 if "Uncertain" and 0 if the answer was "No", and the scores were added to form an index on willingness or intention to provide abortion services in future practice, with a Cronbach's Alpha value of 0.7548. Generally a Cronbach's Alpha value of between 0.7–0.8 indicates internal consistency for a reliable scale [18].

Frequency tables were run to show the distribution of the sample according to selected variables, and students' attitudes toward various types of abortion education. Cross-tabulations were run to compare the proportion of students agreeing or disagreeing with abortion education across the categories of selected variables. Chi-square tests were used to test for significant association between the dependent and independent variables.

Because the independent variables may have confounding effects on students' attitudes toward abortion education, multiple logistic regressions were performed to assess the net effects of selected variables on students' opinions on four types of abortion education. The odds ratio from the logistic regression measures the probability of an event occurring (e.g. student agreeing to more abortion education) with the probability of an event not occurring [$p/(1-p)$], where p is the probability of an event occurring [19].

Results

Of the 991 students in this analysis, exactly two thirds were from the public universities. A quarter of the respondents were Year 1 students, 32% were Year 3 students and 43% were Year 5 students. Sixty three percent were female. The sample comprised 46.9% Malays, 37.6% Chinese, 12.0% Indians, and 3.5% others (Table 1). The ethnic distribution of the respondents corresponded closely to the ethnic composition in these medical schools. There was almost equal number of students according to the three categories of pro-choice index. About half of the students had a score of 6 to 9 on their intention to provide abortion services in

future practice, while about one quarter each had a score of below 6, and 10 and above respectively (Table 1).

The majority of students (about 90% or more) agreed that there should be more training in general knowledge and legal aspects of abortion, and pre- and post-abortion counseling. However, 21.7% and 17.3% were neutral on the need for more training in surgical abortion techniques and medical abortion respectively. Only a small number of students disagreed with having more training on the various types of abortion education in the medical curriculum (Table 2).

Male and female students from both public and private universities did not differ significantly in their opinion on any type of abortion education (Table 3). However, year of study was significantly associated with students' attitudes toward more training on surgical and medical abortion ($p<0.05$) and the legal aspect of abortion ($p<0.01$). Year 5 students were much more likely than their juniors, especially Year 1 students, to want more training on abortion education. Senior students tended to have better knowledge on various aspects, including the curriculum, as compared to their juniors. This is consistent with finding of a study among medical students in the University of British Columbia, where senior students were found to be more knowledgeable than their juniors [14]. Being aware of the lack of abortion education through the years, it is not surprising that senior students were more likely to express a desire for wanting more training in abortion. There was no significant ethnic differential in the attitudes toward more training in general knowledge, surgical and medical abortion and the legal aspect. However, the Chinese and Indians were more likely than the Malays to want more training on pre- and post-abortion counseling ($p<0.05$). Pro-choice students were much more likely to want more training on surgical and medical abortion, and pre-and post-abortion counseling, as compared to those who were not pro-choice ($p<0.01$). As expected, the desire for abortion education was higher among students who expressed an intention to provide abortion service in future practice than those who had no intention to provide such service ($p<0.01$).

In Table 4, an odds ratio of 0.86 indicates that the odds of students from private university wanting more training on surgical abortion techniques was 14% ($1-0.86$) lower than those from the public universities, the reference group. On the other hand, the odds of students from private university wanting more training on medical abortion was 1.09 times (or 9%) higher than those from public universities. However, difference in the opinion on the various types of abortion education between students from public and private universities was not statistically significant. Year 3 and Year 5 students were about 2.4 times and 2.5 times more likely than Year 1 students to want more training on the legal aspect of abortion, and the differences were statistically significant, as the confidence interval did not contain "1". Malay students were more likely to want more training on surgical abortion techniques as compared to the other ethnic groups. On the other hand, Chinese students were more likely to want more training on the legal aspects of abortion and pre- and post-abortion counseling. However, the ethnic differentials in student attitudes toward more training on various types of abortion education were not statistically significant. Controlling for other variables in the model, pro-choice students and those who would provide abortion services in future practice were much more likely to want more training in all aspects of abortion education, as compared to those who were not pro-choice and would not provide abortion service in their future practice.

Table 1. Distribution of respondents by selected variables.

	Frequency	Percent
Total	991	100.0
Type of university		
Public	661	66.7
Private	330	33.3
Year of study		
Year 1	249	25.1
Year 3	317	32.0
Year 5	425	42.9
Gender		
Male	363	36.6
Female	628	63.4
Ethnicity		
Malays	465	46.9
Chinese	372	37.6
Indians	119	12.0
Others	35	3.5
Pro-choice index		
Below 29	310	31.3
29–36	343	34.6
37+	338	34.1
Intention to provide abortion service		
Less than 6	240	24.2
6 to 9	509	51.4
10+	242	24.4

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Table 2. Students' opinions on the inclusion of various types of abortion education into the medical curriculum (n = 991).

Types of abortion education	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
General knowledge on abortion	47.6	45.2	6.8	0.2	0.2
Surgical abortion techniques	32.0	43.9	21.7	1.7	0.7
Medical abortion	34.0	47.0	17.3	1.2	0.5
Legal aspects of abortion	47.8	41.1	9.1	1.2	0.8
Pre- and post-abortion counseling	44.3	43.0	11.0	1.1	0.6

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Discussion

The transition from unsafe to safe abortion requires abortion training for service providers, and provision of services at the appropriate primary level health service delivery points, to ensure

that women have access to these services instead of having to seek out services from untrained providers [20]. A study in Africa shows that with the introduction of medical abortion, thousands of women's lives were saved [21]. Despite the call by the Edinburgh Declaration of the World Medical Association (1998) [22] for

Table 3. Percent of respondents agreeing to the inclusion of the various types of abortion education in the curriculum by selected variables.

	General knowledge on abortion	Surgical abortion techniques	Medical abortion	Legal aspects of abortion	Pre- and post-abortion counseling
Type of university					
Public	92.0	75.3	79.6	87.7	86.1
Private	94.5	77.0	83.6	91.2	89.4
Year of study					
Year 1	89.6	72.7	75.9	81.5	83.5
Year 3	93.4	72.9	81.1	91.2**	87.1
Year 5	94.4	80.0	83.8*	91.5**	89.4
Gender					
Male	91.7	75.2	81.3	89.3	87.6
Female	93.5	76.3	80.7	88.7	86.9
Ethnicity					
Malays	90.8	74.0	78.5	88.2	83.9
Chinese	94.6	79.3	84.7	90.9	90.9*
Indians	94.1	76.5	79.8	85.7	88.2
Others	97.1	62.9	77.1	88.6	88.6
Pro-choice index					
Below 29	91.9	69.0	73.2	89.4	82.3
29–36	93.0	74.3	81.6*	88.6	88.6
37+	93.5	83.7**	87.3**	88.8	90.2**
Intention to provide abortion service					
Less than 6	90.8	64.6	68.3	85.4	77.1
6 to 9	92.9	76.2**	82.7**	88.2	88.2**
10+	94.6	86.4**	89.7**	93.8*	95.0**

Note: * statistically significant; $p < 0.05$;

** $p < 0.01$ as compared to the group with the lowest value. Differences of all other pairwise comparisons are not statistically significant except * between pro-choice 29–36 and 37+ on surgical abortion techniques and intention 6 to 9 and 10+ on counseling; and ** between intention 6 to 9 and 10+ on surgical abortion techniques.

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Table 4. Logistic regressions on students' desire for the various types of abortion education.

	Surgical abortion techniques		Medical abortion		Legal aspects of abortion		Pre- and post- abortion counseling	
	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
Type of university								
Public (Reference)	1.00		1.00		1.00		1.00	
Private	0.86	(0.60, 1.25)	1.09	(0.72, 1.65)	1.08	(0.63, 1.87)	1.16	(0.71, 1.88)
Year of study								
Year 1 (Reference)	1.00		1.00		1.00		1.00	
Year 3	0.95	(0.64, 1.43)	1.19	(0.77, 1.84)	2.35**	(1.36, 4.05)	1.12	(0.67, 1.85)
Year 5	1.41	(0.92, 2.15)	1.34	(0.86, 2.10)	2.52**	(1.45, 4.39)	1.31	(0.78, 2.22)
Ethnicity								
Malays (Reference)	1.00		1.00		1.00		1.00	
Chinese	0.91	(0.63, 1.33)	1.01	(0.67, 1.52)	1.49	(0.89, 2.49)	1.53	(0.93, 2.50)
Indians	0.82	(0.49, 1.37)	0.69	(0.40, 1.21)	0.75	(0.39, 1.44)	1.13	(0.58, 2.20)
Others	0.57	(0.27, 1.20)	0.91	(0.39, 2.13)	1.14	(0.38, 3.42)	1.67	(0.56, 4.95)
Pro-choice index								
Below 29 (Reference)	1.00		1.00		1.00		1.00	
29–36	1.09	(0.75, 1.58)	1.28	(0.86, 1.92)	0.70	(0.41, 1.19)	1.11	(0.69, 1.80)
37+	1.71*	(1.08, 2.71)	1.69*	(1.03, 2.79)	0.53*	(0.28, 0.97)	0.89	(0.50, 1.59)
Intention to provide abortion service								
Less than 6 (Reference)	1.00		1.00		1.00		1.00	
6 to 9	1.53*	(1.07, 2.19)	1.88**	(1.28, 2.76)	1.25	(0.76, 2.04)	2.01**	(1.30, 3.11)
10+	2.72**	(1.65, 4.47)	3.01**	(1.75, 5.19)	2.70**	(1.34, 5.44)	5.07**	(2.49, 10.30)
Constant	1.98		1.53		3.67		2.18	

Note: Odds ratios and [95% confidence intervals] from logistic regression models predicting students' desire to have more training on various aspects of abortion.

*and ** denote statistical significance at the 0.05 and 0.01 levels, respectively.

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medical schools to produce professionals who are able to understand the needs of the communities and to respond accordingly, medical schools in Malaysia and other developing countries do not offer sufficient training to equip students with the knowledge and skills necessary to counsel patients about abortion and to become abortion providers [14,23].

In Malaysia, family planning services are not available to unmarried persons. With the trend towards delayed marriage [24], and more and more adolescents becoming sexually active, issues such as youth sexuality, unwanted pregnancies and baby abandonment have become serious social problems. Presumably, some women may have resorted to unsafe abortion.

The growing concern over adolescent sexual behavior led to the adoption of the National Adolescent Health Policy in 2001, and the National Reproductive Health and Social Education Policy in 2010. The stagnation of the contraceptive prevalence rate and high level of unmet need have also been highlighted at various forums. More innovative approaches, including abortion counseling and management, need to be adopted to complement the family planning efforts. Those responsible for undertaking the curriculum review may need to be more sensitive to the prevailing sentiments and concerns on the sexuality problems. New elements of abortion education such as counseling as a means to help prevent out-of-wedlock and unwanted pregnancies need to be introduced.

There will always be barriers to the inclusion of abortion education in the medical curriculum, even in developed countries [25], due to pressure from the anti-choice and pro-life movements. One way to circumvent the restrictions and rejection of abortion education is to incorporate abortion training into public and reproductive health education.

While greater contraceptive use can be expected to reduce induced abortion, as shown in a study by Bongaarts and Westoff [26], other studies showed no significant association between induced abortion and contraceptive use [27,28]. The parallel rise in abortion and contraception in some countries has occurred because increased contraceptive use alone was unable to meet the growing need for fertility regulation in situations where fertility was falling rapidly [28]. Hence, there is a need to offer abortion services alongside family planning.

Non-government organizations (NGOs) are playing an important role in providing abortion information and counseling in Malaysia. The Federation of Reproductive Health Association Malaysia (FRHAM) has set a goal for universal recognition of women's right to have access to safe abortion and a reduction in the incidence of unsafe abortion. FRHAM and its member associations aim to provide safe, sensitive, non-judgmental and affordable abortion-related services (including pre- and post-abortion counseling), with special attention to young women, the under-served and marginalized groups. These organizations also act as referral centers for post-abortion care, treatment of

complications and contraceptive services [29]. In 2007, the Reproductive Rights Advocacy Alliance of Malaysia was formed as part of the Asia Safe Abortion Partnership, with the objective to inform, educate, and advocate on reproductive health issues, including abortion [30]. The missions and concerns of these NGOs point to the need to improve access to safe abortion services.

A survey on medical students in the United States found that 96% of the respondents indicated that abortion education was appropriate in the preclinical and clinical curricula. The same study also found that about three quarters of students who planned a career in Family Medicine and Obstetrics and Gynecology preferred the integration of abortion training into the residency curriculum [13]. Respondents in our survey were not asked about the appropriateness of abortion education in preclinical and clinical curricula. However, it is likely that medical students in Malaysia would share the same view with their American counterparts, as the level of acceptance of abortion training among medical students in Malaysia was as high as in the United States [10–13].

In planning the survey, special attention was given to the study design. Nevertheless, the study still has a number of limitations. The survey was conducted in only three universities. A selected private university did not give us the permission to conduct the survey, and it was not replaced with another university due to time constraint. Moreover, the survey did not collect information on the perceptions of normative beliefs within the family, among peers and society which would have an impact on attitudes toward abortion and abortion education. In a multi-ethnic country like Malaysia, ethnicity is an important variable in most socio-economic and attitudinal research, as the ethnic variable subsumes many cultural and religious dimensions. In some populations, religion may be an important variable in explaining people's attitudes toward abortion. This variable was not included in the questionnaire because of the strong association between ethnicity and religion. In Malaysia, all Malays are Muslim, 84% of the Chinese are Buddhist, and 86% of the Indians are Hindu. It turned out that the ethnic variable which subsumes various socio-cultural and religious norms in Malaysia did not have any

significant effect on the students' attitudes toward abortion education. As more than 90% of students wanted at least some abortion education, any sampling bias is unlikely to change significantly the key finding that most medical students want more abortion education. Hence, the survey findings provide a strong case for abortion curriculum reform.

Conclusion

Our survey showed that almost all medical students in both public and private universities were in favor of having more training in abortion. Moreover, about 80% of the medical students in this survey reported an intention to provide some forms of abortion services in their future practice. Clearly, there is a need to equip medical students with skills and knowledge to meet the increasing demand for safe abortion. Such a need was unanimously endorsed by participants of a national seminar held to discuss the findings from this survey and two other related surveys.

Abortion education can be incorporated into existing courses along with family planning and reproductive health modules to avoid any opposition that may arise. Curriculum reform to improve abortion education would result in improved reproductive health care for women, and to enable them to exercise their reproductive rights.

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Author Contributions

Conceived and designed the experiments: NPT SY Y WYL MSLH PR WTT. Performed the experiments: NPT SY Y WYL LS PR WTT. Analyzed the data: NPT SLL. Wrote the paper: NPT SLL. Reviewed and revised the manuscript: NPT SY Y WYL LS PR MSLH WTT SLL. Final approval of the manuscript: NPT SY Y WYL LS PR MSLH WTT SLL.

References

- Department of Reproductive Health and Research WHO (2011) Unsafe abortion: Global and regional estimates of the incidence of unsafe abortion and associated mortality in 2008. Geneva WHO. 56 p.
- Singh S, Wulf D, Hussain R, Bankole A, Sedgh G (2009) Abortion Worldwide: A Decade of Uneven Progress. New York: Guttmacher Institute.
- Sedgh G, Singh S, Henshaw SK, Bankole A (2011) Legal abortion worldwide in 2008: levels and recent trends. *International Perspectives on Sexual and Reproductive Health* 37: 84–94.
- Tey NP, Ng ST, Yew SY (2012) Proximate determinants of fertility in Peninsular Malaysia. *APJPH* 24(3): 495–505.
- Department of Economic and Social Information and Policy Analysis UNPD (2003) Abortion policies: A global review. Available: <http://www.un.org/esa/population/publications/abortion/>. Accessed 2012 Nov 30.
- Singh S, Wulf D, Jones H (1997) Health professionals' perceptions about induced abortion in South, Central and Southeast Asia. *Int Fam Plan Perspec* 23: 59–67.
- Rahman A, Katzive L, Henshaw SK (1998) A global review of laws on induced abortion, 1985–1997. *Int Fam Plan Perspec* 24: 56–64.
- Dalvie S, Barua A, Choong S, Chin O, Ramasami S A study of knowledge, attitudes and understanding of legal professionals about safe abortion as a woman's right in Malaysia. Asia Safe Abortion Partnership. Available: <http://www.asap-asia.org/kmitan/articleback.php?newsid=1>. Accessed 2012 Nov 30.
- Daher AM, Amin F (2010) Assessing the perceptions of a biostatistics and epidemiology module: Views of Year 2 medical students from a Malaysian university. A cross-sectional survey. *BMC Med Educ* 10.
- Shotorbani S, Zimmerman FJ, Bell JF, Ward D, Assefi N (2004) Attitudes and intentions of future health care providers toward abortion provision. *Perspect Sex Reprod Health* 36: 58–63.
- Espey E, Ogburn T, Dorman F (2004) Student attitudes about a clinical experience in abortion care during the obstetrics and gynecology clerkship. *Acad Med* 79: 96–100.
- Espey E, Ogburn T, Chavez A, Qualls C, Leyba M (2005) Abortion education in medical schools: a national survey. *Am J Obstet Gynecol* 192: 640–643.
- Espey E, Ogburn T, Leeman L, Nguyen T, Gill G (2008) Abortion education in the medical curriculum: a survey of student attitudes. *Contraception* 77: 203–208.
- Cessford TA, Norman W (2011) Making a case for abortion curriculum reform: A knowledge-assessment survey of undergraduate medical students. *J Obstet Gynaecol Can* 33: 38–45.
- Department of Statistics (2010) Population and Housing Census of Malaysia: Population Distribution and Basic Characteristics, 2010. Putrajaya, Malaysia.
- United Nations Statistics Division. (2012) Demographic and social statistics. Available: <http://unstats.un.org/unsd/demographic/>. Accessed 2012 Nov 30.
- Ministry of Higher Education Malaysia (2010) Statistics on Higher Education Malaysia. Putrajaya, Malaysia. Available: http://www.mohe.gov.my/web_statistik/perangkaan_2010.pdf. Accessed 2012 Nov 30.
- Field A (2005) *Discovering Statistics Using SPSS*. London: Sage Publications.
- Hosmer DW, Lemeshow S (2000) *Applied Logistic Regression*. New York: Wiley.
- Berer M (2002) Making abortions safe: A matter of good public health policy and practice. *Reprod Health Matters* 10: 31–34.
- Baggaley RF, Burgin J, Campbell OMR (2010) The Potential of Medical Abortion to Reduce Maternal Mortality in Africa: What Benefits for Tanzania and Ethiopia? *PLoS ONE* 5: e13260.
- Edinburgh Declaration. (1998) Edinburgh, UK. World Medical Association.

23. Ahmed FA, Moussa K, Petterson KO, Asamoah BO (2012) Assessing knowledge, attitude, and practice of emergency contraception: a cross-sectional study among Ethiopian undergraduate female students. *BMC Public Health* 12.
24. Tey NP (2007) Trends in delayed and non-marriage in Peninsular Malaysia. *Asian Population Studies* 3: 243–261.
25. Leeman L, Espey E (2005) You can't do that 'round here': a case study of the introduction of medical abortion care at a university medical center. *Contraception* 71: 84–88.
26. Bongaarts J, Westoff CF (2000) The potential role of contraception in reducing abortion. *Stud Family Plann* 31: 193–202.
27. Singh S, Sedgh G (1997) The relationship of abortion to trends in contraception and fertility in Brazil, Colombia and Mexico. *International Family Planning Perspectives* 23: 4–14.
28. Marston C, Cleland J (2003) Relationships between contraception and abortion: A review of the evidence. *Int Fam Plan Perspec* 29: 6–13.
29. Federation of Reproductive Health Associations Malaysia Abortion. Available: http://www.frham.org.my/index.php?option=com_content&view. Accessed 2012 Feb 12.
30. Reproductive Rights Advocacy Alliance of Malaysia Speaking out on Malaysian women's access to contraception and abortion services. Available: <http://towncriermy.hypermart.net/rraam/about.html>. Accessed 2012 Feb 12.

Research Article

Correlates of and Barriers to the Utilization of Health Services for Delivery in South Asia and Sub-Saharan Africa

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The high maternal and neonatal mortality rates in South Asia and Sub-Saharan Africa can be attributed to the lack of access and utilization of health services for delivery. Data from the Demographic and Health Surveys conducted in Bangladesh, India, Pakistan, Kenya, Nigeria, and Tanzania show that more than half of the births in these countries were delivered outside a health facility. Institutional delivery was closely associated with educational level, family wealth, place of residence, and women's media exposure status, but it was not influenced by women's work status and their roles in decision-making (with the exception of Nigeria). Controlling for other variables, higher parity and younger women were less likely to use a health facility for delivery. Within each country, the poorer, less educated and rural women had higher unmet need for maternal care services. Service related factors (accessibility in terms of cost and distance) and sociocultural factors (e.g., did not perceive the need for the services and objections from husband and family) also posed as barriers to institutional delivery. The paper concludes with some suggestions to increase institutional delivery.

1. Introduction

Globally, approximately 287,000 women died from causes related to pregnancy and childbirth in 2010. Of these, 162,000 were in Sub-Saharan Africa and 83,000 were in South Asia. The maternal mortality ratio (MMR defined as the number of women who die during pregnancy and childbirth per 100,000 live births) ranges from 16 in the developed countries to 220 in South Asia and 500 in Sub-Saharan Africa [1]. Lack of access to and utilization of health care services for delivery are among the main reasons for the high maternal and neonatal mortality rates in these regions [2–5]. Maternal death can occur anytime in pregnancy, but delivery is by far the most dangerous time for both mother and baby [6].

The major complications that account for 80 percent of all maternal deaths are severe bleeding and infections after childbirth, high blood pressure during pregnancy and unsafe abortion [7]. Antenatal care, delivery by skilled health professionals, and postnatal care would ensure timely management and treatment of complications to reduce maternal deaths. Despite the importance of institutional delivery in preventing

maternal death, about 42 percent of the births in developing countries were delivered outside a health facility, and 35 percent were not attended by trained personnel. Noninstitutional delivery made up more than 80 percent of the births in a few less developed countries such as Ethiopia (95 percent), Afghanistan, Bangladesh, Lao People's Democratic Republic, and Nepal [8].

Factors that prevent women from receiving or seeking health care during pregnancy and childbirth include inadequate services, poverty, distance, lack of information, and cultural practices [7, 8]. Health facilities and services vary widely between the developed and developing countries. In low resource countries, the hospital bed-population and doctor-population ratio was about 0.4 and 0.2 per 1,000 population respectively, while the corresponding figures for the developed countries are 6 and 3 per thousand population. Health expenditure per capita ranges from a mere USD 26.8 in low income countries to USD 224 in middle income countries, USD 382 in upper middle income countries and USD 4,879 in high income countries [9].

Numerous studies on the utilization of health facilities have been carried out at the national or subnational level in various parts of the world, including Sub-Saharan Africa and South Asia [10–19]. However, comparative study on the utilization of maternal care services between the two regions is relatively scarce. One particular study that covers the two regions provided the estimates on the number of births in Sub-Saharan Africa and South Asia that will not be attended by a skilled birth attendant between 2011 and 2015 [20]. A cross-country analysis using data from DHS conducted in 31 countries indicates that women's education, economic status, and empowerment are closely associated with the utilization of maternal health services. DHS data from 21 countries in Sub-Saharan Africa show that teenagers in the region have poorer maternal health care than older women with similar background characteristics [21].

The main objective of this paper is to examine the determinants of sociocultural, service and information related barriers to the use of health facilities for childbirth. A better understanding of these barriers is essential for implementing various strategies to increase women's utilization of health facilities to reduce maternal and child deaths.

2. Materials and Methods

2.1. Data. Data for this study come from the Demographic and Health Surveys (DHS) conducted in 3 selected South Asian countries and 3 African countries in 2006–2010. MEASURE DHS Project has been funded by USAID with contributions from other donors to carry out surveys in developing countries on demographic and health issues that can inform policy. The DHS apply multistage probability sampling to provide nationally representative samples of women of reproductive age (i.e., aged 15–49 years). Since 1984, DHS have been conducted in 85 countries based on a set of core questionnaires to allow comparison across countries. The data are available to researchers through an online database [22].

Bangladesh, India, and Pakistan were chosen to represent South Asia subcontinent, while Kenya, Nigeria, and Tanzania were chosen to represent the Sub-Saharan Africa. These countries were selected based on the population size and the availability of DHS data for the most recent period—2007 for Bangladesh, 2006 for India, 2007 for Pakistan, 2009 for Kenya, 2008 for Nigeria, and 2010 for Tanzania.

The proportion of women who had more than one birth in the five years prior to the survey ranged from about one-quarter in Bangladesh to one-third in India and 45–52 percent in the other four countries in this study. This analysis is based on the most recent birth within the reference period.

2.2. Statistical Methods. Place of delivery, type of birth attendants, and reasons for not using a health facility for the delivery are the dependent variables for this study. For logistic regression analysis, place of delivery and type of birth attendant were recoded into binary variables, taking the value 1 for institutional delivery, 0 otherwise, and 1 for delivery by trained personnel, 0 otherwise.

The independent variables may be classified as individual-level variables (educational level of women and husband, maternal age, media exposure, women's work status, and their status in the family); household-level variables (family income or wealth); and community-level variables (urban-rural residence). In previous studies, education, household socioeconomic status, and urban-rural residence are consistently significant predictors of service utilization, while all other variables are less consistent predictors across studies [2, 10–12, 16, 23–38].

Household income data were not collected in DHS. Instead, the data sets contain a variable on the household's quintile classification of wealth index generated through principal component analysis based on household ownership of various assets and on housing characteristics. Description of the construction of this variable can be read from the report for each country.

Women's status is represented by a variable on whether a woman has a final say on her own health care (Yes = 1, No = 0).

Media exposure is an index based on the following:

- (i) frequency of reading newspaper or magazine (more frequent = 1/less frequent = 0);
- (ii) frequency of listening to radio;
- (iii) frequency of watching television.

Women who scored 0 to 1 were grouped as a "Low" exposure to the media and 2 to 3 were grouped as a "High" exposure to the media.

We began with a description of the sample distribution for each independent variable, followed by the distribution of place of delivery and the type of birth attendant for each country. The independent variables were interrelated with one another, with confounding effects on delivery care. For instance, family wealth index was closely associated with the educational level of women and their husband; higher educated women tended to marry higher educated men; and educational level and financial status were also closely associated with media exposure and birth parity. Binary logistic regression analyses were used to examine the odds of using health facilities and services for delivery within the multivariate context. Each of these variables represents a different construct, and the problem with multicollinearity is not a concern.

Odds ratio of value greater than 1 shows that the likelihood of the occurrence of an event is higher in a particular group as compared to the reference group, and vice versa. Odds ratio of less than 1 is deducted from 1 and interpreted as a percent less likely. For instance, an odds ratio of 0.8 is interpreted as 20 percent less likely for the occurrence of an event as compared to the reference group.

3. Results

3.1. Characteristics of the Samples. The sample for this study was based on the last birth of currently married women aged 15–49 years who had given birth 5 years preceding the survey. Table 1 summarizes the total sample for each country and the percentage distribution by the independent variables.

TABLE 1: Percentage distribution of the study population by country.

Variables	Kenya	Nigeria	Tanzania	Bangladesh	India	Pakistan
Sample size	3,365	17,025	4,510	4,811	36,115	5,655
Place of residence						
Rural	74.2	73.3	80.0	64.6	60.5	65.0
Urban	25.8	26.7	20.0	35.4	39.5	35.0
Wife's education						
None	19.9	50.9	24.7	25.4	38.2	66.5
Primary	55.4	22.1	62.7	30.5	14.2	13.8
Secondary+	24.7	27.1	12.6	44.1	47.6	19.6
Husband's education						
None	15.2	41.4	17.5	31.7	22.6	36.5
Primary	47.5	20.7	67.4	28.3	14.4	16.2
Secondary+	37.3	37.8	15.0	40.0	63.1	47.3
Women's work						
Not working	44.9	35.2	17.9	76.0	71.0	76.1
Working	55.1	64.8	82.1	24.0	29.0	23.9
Final say on own health care						
No	30.3	59.3	43.6	39.1	35.9	—
Yes	69.7	40.7	56.4	60.9	64.1	—
Wealth index						
Poorest	26.5	26.7	18.5	19.1	16.6	22.4
Poorer	16.9	23.6	21.6	19.9	17.5	21.6
Middle	16.4	19.1	20.5	18.5	20.1	19.6
Richer	16.8	16.6	21.7	19.2	22.1	18.6
Richest	23.4	14.0	17.6	23.4	23.7	17.9
Media exposure						
Low	70.4	75.9	81.1	83.3	69.0	—
High	29.6	24.1	18.9	16.7	31.0	—
Age						
<30	57.7	52.2	51.5	73.5	70.2	52.9
30-39	34.4	35.7	36.2	23.3	26.9	37.7
40+	7.9	12.2	12.4	3.2	2.9	9.4
Birth parity						
1-2	37.8	31.6	33.1	57.9	57.7	35.3
3-4	31.5	29.0	30.1	28.3	27.4	28.4
5+	30.7	39.5	36.8	13.9	14.9	36.2

The level of urbanization in all the six countries was considerably lower than the average for the less developed world which stood at 46 percent in 2010. A significant proportion of women and their husbands in these countries had never been to school. Gender gap in education was most pronounced in Pakistan, where two-thirds of the women had never been to school. Women in the three Sub-Saharan African countries, especially in Tanzania, had very high labor force participation rate. In contrast, few women in South Asia were reported as working.

In the five countries where data are available, women in Kenya had relatively high status in the family as compared to the rest. In contrast, Tanzanian women had the lowest status within the family. Women in all the six countries in this study had low media exposure.

For the wealth quintile, the deviation from 20 percent for the various subgroups can be explained by the uneven

distribution of childbearing women in the 5 years preceding the survey. In Kenya, Nigeria, and Pakistan, women giving births in the five years before the survey were over-represented by those in the poorest wealth quintile, but they were over-represented by those in the richest quintile in Bangladesh and India.

The modal age group was below 30 years for all the six countries, with Bangladesh and India having the youngest age structure. Except for Bangladesh and India, the number of women having 1-2, 3-4, and 5 or more children was rather evenly split.

3.2. Place of Delivery and Birth Attendance. In all the six countries, more than half of the births occurred outside a health facility, and most of these were home delivery. Figure 1 shows that noninstitutional delivery was highest in Bangladesh, followed by Nigeria and Pakistan. Of those who

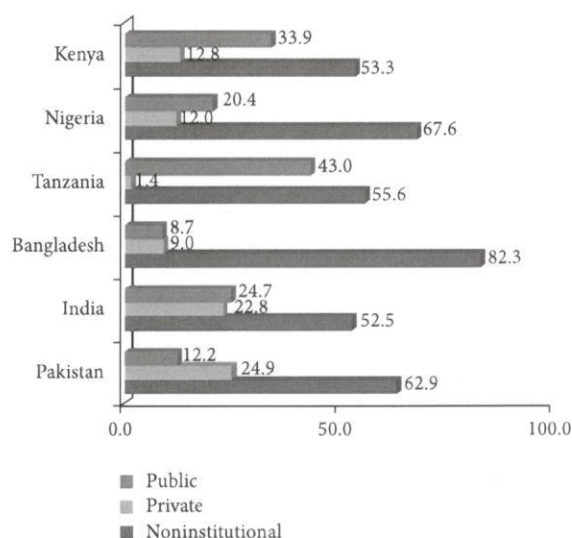


FIGURE 1: Percentage distribution of the place of delivery by country.

delivered in a health facility, women from the three Sub-Saharan African countries were much more likely to deliver in a public health facility rather than a private health facility. In Bangladesh and India, about the same proportion of women used the public and private health facilities but Pakistani women were twice as likely to use a private health facility rather than a public health facility for childbirth.

Use of trained attendant for delivery corresponded closely with the place of delivery. All the births that occurred in a hospital or clinic were delivered by a trained attendant. A sizable proportion of home delivery was attended by trained personnel, and this ranged from 5–6 percent in Bangladesh, Kenya, and Nigeria to 15–17 percent in Tanzania and India. The proportion of births attended by an untrained attendant, including traditional midwives, was highest in Bangladesh (76.9 percent) and lowest in India (46.9 percent). There was no discernible difference in births attended by untrained personnel between South Asia and Sub-Saharan Africa. In South Asia, most of the deliveries by trained attendants were conducted by doctors, but nurses were the main birth attendants in the three Sub-Saharan African countries (Figure 2).

3.3. Determinants of the Use of Health Facilities and Services for Delivery. Logistic regressions were used to examine the determinants of the use of health facilities for childbirth in the multivariate context (Table 2). In all the six countries under study, place of residence, educational level of women and their husbands, wealth index, women's exposure to media, maternal age, and birth parity had significant effects on the use of a health facility for delivery. In Tanzania and India, rural women were only half as likely as urban women to deliver in a health facility, but the urban-rural effect was much smaller in Nigeria, where rural women were 24 percent less likely than urban women to give birth in a health facility.

Utilization of health facilities for delivery also varied widely by region within each country, probably due to the uneven distribution of hospitals, health centers, and clinics,

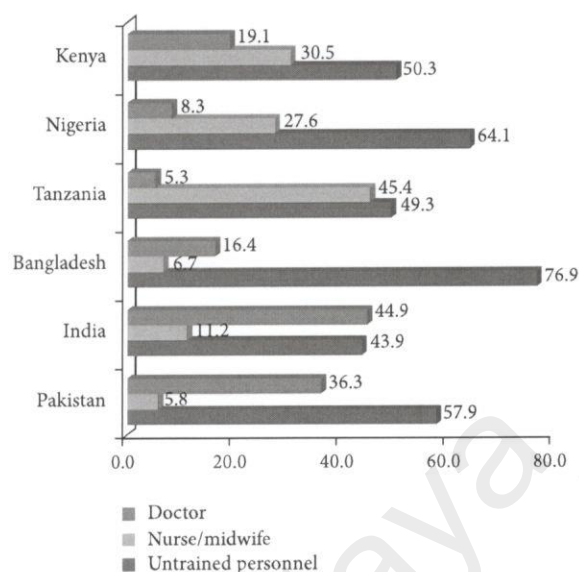


FIGURE 2: Percentage distribution of the type of birth attendant by country.

with concentration in the more developed regions. More detailed tabulations of DHS data show that women from the more developed regions were much more likely than those from the less developed region to deliver in a health facility. In all countries, rural women were much less likely than urban women to use a health facility for delivery (11.6 percent versus 26.5 percent in Bangladesh, 18.2 percent versus 99.3 percent in India, 21.2 percent versus 44.6 percent in Pakistan, 21.2 percent versus 88.6 percent in Kenya, 8.3 percent versus 70.7 percent in Nigeria, and 22.9 percent versus 72.1 percent in Tanzania).

In all the six countries, women who had never been to school were least likely to have institutional delivery, while those with at least secondary education were most likely to do so. The educational effect on institutional delivery was weakest in Tanzania. In Nigeria and all the three countries in South Asia, the effect of the wife's education on the use of a health facility for childbirth was much stronger than that of the husband's education.

The odds of using a health facility for delivery were about the same for both working and nonworking women in Tanzania and the three South Asian countries. In these four countries, higher educated women were less likely to work as compared to their lesser educated counterparts. In Kenya and Nigeria, where working women had higher odds of institutional delivery, higher educated women were more likely than lesser educated women to be currently working.

With the exception of Nigeria, there was no significant difference in institutional delivery between women who had a say in their own health care and those who did not have a say. In Nigeria, women with no say were significantly less likely to use a health facility for delivery. Contrary to expectation, Indian women who did not have a say in their health care were a little more likely than those who have a say to deliver in a health facility.

TABLE 2: Logistic regression on “using health facility for delivery in the past 5 years” by selected variables.

Variables	Kenya Odds ratio	Nigeria Odds ratio	Tanzania Odds ratio	Bangladesh Odds ratio	India Odds ratio	Pakistan Odds ratio
Place of residence						
Rural	0.59 (0.4, 0.8)	0.77 (0.7, 0.9)	0.50 (0.4, 0.6)	0.56 (0.5, 0.7)	0.51 (0.5, 0.5)	0.69 (0.6, 0.8)
Urban (reference)	1.00	1.00	1.00	1.00	1.00	1.00
Wife's education						
None	0.37 (0.3, 0.5)	0.24 (0.2, 0.3)	0.69 (0.5, 0.9)	0.21 (0.1, 0.3)	0.43 (0.4, 0.5)	0.43 (0.4, 0.5)
Primary	0.56 (0.4, 0.7)	0.54 (0.5, 0.6)	0.91 (0.7, 1.2)	0.45 (0.4, 0.6)	0.65 (0.6, 0.7)	0.60 (0.5, 0.7)
Secondary+ (reference)	1.00	1.00	1.00	1.00	1.00	1.00
Husband's education						
None	0.36 (0.3, 0.5)	0.60 (0.5, 0.7)	0.61 (0.5, 0.8)	0.57 (0.4, 0.8)	0.89 (0.8, 1.0)	0.78 (0.7, 0.9)
Primary	0.68 (0.6, 0.8)	1.06 (1.0, 1.2)	1.03 (0.8, 1.3)	0.56 (0.4, 0.7)	1.05 (1.0, 1.1)	0.83 (0.7, 1.0)
Secondary+ (reference)	1.00	1.00	1.00	1.00	1.00	1.00
Women's work						
Not working	0.83 (0.7, 1.0)	0.70 (0.6, 0.8)	0.94 (0.8, 1.1)	1.12 (0.9, 1.4)	1.03 (1.0, 1.1)	1.02 (0.9, 1.2)
Working (reference)	1.00	1.00	1.00	1.00	1.00	1.00
Final say on own health care						
No	1.00 (0.8, 1.2)	0.64 (0.6, 0.7)	0.93 (0.8, 1.1)	0.96 (0.8, 1.2)	1.07 (1.0, 1.1)	—
Yes (reference)	1.00	1.00	1.00	1.00	1.00	—
Wealth index						
Poorest	0.18 (0.1, 0.3)	0.10 (0.1, 0.1)	0.28 (0.2, 0.4)	0.33 (0.2, 0.5)	0.14 (0.1, 0.2)	0.18 (0.1, 0.2)
Poorer	0.29 (0.2, 0.4)	0.17 (0.2, 0.2)	0.32 (0.2, 0.4)	0.22 (0.2, 0.3)	0.20 (0.2, 0.2)	0.25 (0.2, 0.3)
Middle	0.44 (0.3, 0.6)	0.30 (0.3, 0.4)	0.44 (0.3, 0.6)	0.33 (0.2, 0.4)	0.33 (0.3, 0.4)	0.32 (0.3, 0.4)
Richer	0.51 (0.4, 0.7)	0.51 (0.4, 0.6)	0.53 (0.4, 0.7)	0.46 (0.4, 0.6)	0.49 (0.5, 0.5)	0.51 (0.4, 0.6)
Richest (reference)	1.00	1.00	1.00	1.00	1.00	1.00
Media exposure						
Low	0.68 (0.6, 0.8)	0.83 (0.8, 0.9)	0.80 (0.7, 1.0)	0.67 (0.6, 0.8)	0.67 (0.6, 0.7)	—
High (reference)	1.00	1.00	1.00	1.00	1.00	—
Age						
<30	0.61 (0.4, 0.9)	0.58 (0.5, 0.7)	0.60 (0.5, 0.8)	0.45 (0.2, 0.9)	0.73 (0.6, 0.9)	0.65 (0.5, 0.9)
30–39	0.87 (0.6, 1.2)	0.88 (0.8, 1.0)	0.82 (0.7, 1.0)	0.84 (0.4, 1.7)	1.06 (0.9, 1.3)	0.81 (0.6, 1.0)
40+ (reference)	1.00	1.00	1.00	1.00	1.00	1.00
Birth parity						
1-2	2.56 (1.9, 3.4)	1.83 (1.6, 2.1)	2.33 (1.9, 2.9)	4.40 (2.7, 7.3)	3.71 (3.4, 4.1)	1.99 (1.7, 2.4)
3-4	1.75 (1.4, 2.2)	1.35 (1.2, 1.5)	1.51 (1.3, 1.8)	2.18 (1.3, 3.6)	1.67 (1.5, 1.8)	1.26 (1.1, 1.5)
5+ (reference)	1.00	1.00	1.00	1.00	1.00	1.00
Constant	8.76	8.08	4.43	0.84	3.33	4.08

Figures in brackets show 95 percent confidence intervals.

Except for Bangladesh, the odds of institutional delivery decreased monotonically from the richest quintile families to the poorest quintile families. In India and Nigeria, women from the poorest quintile families were 86–90 percent less likely than those from the richest quintile families to give birth in a health facility. In all the five countries where data are available, women with low media exposure were much less likely than those with high media exposure to give birth in a health facility.

Of the two demographic control variables, birth parity was a more important predictor of the use of a health facility for childbirth as compared to maternal age. Lower parity women were much more likely than higher parity and older

women to deliver in a hospital or clinic. This suggests that the more experience a woman had in childbirth, the less likely she would use a health facility for delivery. However, controlling for other variables in the model, younger women were less likely than older women to use the health facilities for delivery.

The determinants in the utilization of trained personnel for delivery corresponded rather closely to that of the place of delivery, as shown in Table 3. In India, where the odds of using a health facility for delivery was not significantly different between working and nonworking women, nonworking women were less likely than working women to have a trained birth attendant.

TABLE 3: Logistic regression on "using trained personnel in the past 5 years" by selected variables.

Variables	Kenya Odds ratio	Nigeria Odds ratio	Tanzania Odds ratio	Bangladesh Odds ratio	India Odds ratio	Pakistan Odds ratio
Place of residence						
Rural	0.64 (0.5, 0.8)	0.68 (0.6, 0.8)	0.37 (0.3, 0.5)	0.49 (0.4, 0.6)	0.54 (0.5, 0.6)	0.66 (0.6, 0.8)
Urban (reference)	1.00	1.00	1.00	1.00	1.00	1.00
Wife's education						
None	0.46 (0.3, 0.6)	0.23 (0.2, 0.3)	0.59 (0.4, 0.8)	0.28 (0.2, 0.4)	0.44 (0.4, 0.5)	0.46 (0.4, 0.6)
Primary	0.53 (0.4, 0.7)	0.50 (0.5, 0.6)	0.85 (0.7, 1.1)	0.43 (0.3, 0.5)	0.63 (0.6, 0.7)	0.64 (0.5, 0.8)
Secondary+ (reference)	1.00	1.00	1.00	1.00	1.00	1.00
Husband's education						
None	0.54 (0.4, 0.8)	0.59 (0.5, 0.7)	0.59 (0.5, 0.8)	0.55 (0.4, 0.7)	0.83 (0.8, 0.9)	0.77 (0.7, 0.9)
Primary	0.66 (0.5, 0.8)	1.08 (1.0, 1.2)	1.03 (0.8, 1.3)	0.55 (0.5, 0.7)	0.97 (0.9, 1.0)	0.80 (0.7, 1.0)
Secondary+ (reference)	1.00	1.00	1.00	1.00	1.00	1.00
Women's work						
Not working	0.89 (0.8, 1.1)	0.67 (0.6, 0.7)	0.96 (0.8, 1.2)	1.21 (1.0, 1.5)	0.94 (0.9, 1.0)	0.95 (0.8, 1.1)
Working (reference)	1.00	1.00	1.00	1.00	1.00	1.00
Final say on own health care						
No	1.12 (0.9, 1.3)	0.66 (0.6, 0.7)	0.79 (0.7, 0.9)	0.91 (0.8, 1.1)	1.05 (1.0, 1.1)	—
Yes (reference)	1.00	1.00	1.00	1.00	1.00	—
Wealth index						
Poorest	0.21 (0.1, 0.3)	0.08 (0.1, 0.1)	0.24 (0.2, 0.3)	0.26 (0.2, 0.4)	0.14 (0.1, 0.2)	0.18 (0.1, 0.2)
Poorer	0.29 (0.2, 0.4)	0.15 (0.1, 0.2)	0.27 (0.2, 0.4)	0.19 (0.1, 0.3)	0.18 (0.2, 0.2)	0.25 (0.2, 0.3)
Middle	0.43 (0.3, 0.6)	0.26 (0.2, 0.3)	0.38 (0.3, 0.5)	0.31 (0.2, 0.4)	0.29 (0.3, 0.3)	0.33 (0.3, 0.4)
Richer	0.51 (0.4, 0.7)	0.46 (0.4, 0.5)	0.50 (0.4, 0.7)	0.44 (0.4, 0.6)	0.45 (0.4, 0.5)	0.54 (0.4, 0.7)
Richest (reference)	1.00	1.00	1.00	1.00	1.00	1.00
Media exposure						
Low	0.66 (0.5, 0.8)	0.83 (0.7, 0.9)	0.78 (0.6, 1.0)	0.62 (0.5, 0.8)	0.65 (0.6, 0.7)	—
High (reference)	1.00	1.00	1.00	1.00	1.00	—
Age						
<30	0.60 (0.4, 0.9)	0.62 (0.5, 0.7)	0.50 (0.4, 0.7)	0.53 (0.3, 1.0)	0.81 (0.7, 1.0)	0.64 (0.5, 0.8)
30-39	0.92 (0.7, 1.3)	0.94 (0.8, 1.1)	0.75 (0.6, 0.9)	0.94 (0.5, 1.8)	1.12 (1.0, 1.3)	0.82 (0.7, 1.0)
40+ (reference)	1.00	1.00	1.00	1.00	1.00	1.00
Birth parity						
1-2	2.49 (1.9, 3.2)	1.85 (1.6, 2.1)	3.11 (2.5, 3.9)	3.33 (2.2, 5.1)	3.45 (3.1, 3.8)	2.07 (1.7, 2.5)
3-4	1.69 (1.4, 2.1)	1.36 (1.2, 1.5)	1.84 (1.5, 2.2)	1.62 (1.1, 2.4)	1.67 (1.5, 1.8)	1.25 (1.1, 1.5)
5+ (reference)	1.00	1.00	1.00	1.00	1.00	1.00
Constant	8.96	12.79	10.20	1.76	6.31	5.39

Figures in brackets show 95 percent confidence intervals.

Family wealth index provides consistently the sharpest differentials in the odds for delivery by a trained attendant across all the six countries. Poorest women in Nigeria were 92 percent less likely to have their births attended by a trained attendant, and in India where the differential was smallest, the corresponding figure was 74 percent. Place of residence, educational level of women and their husbands, and birth parity are significant variables in predicting delivery by a trained attendant, and the findings are in congruence with that of the place of delivery.

3.4. Reasons for Not Using Health Facilities and Skilled Birth Attendants for Delivery. Except for Bangladesh, DHS in the other five countries collected information on the reasons for

not delivering in a hospital or clinic. The mean number of responses ranged from 1.03 in Tanzania to 1.3 in Pakistan. Table 4 shows that the reasons for not using the health facility for delivery varied widely across countries. A high proportion of women in Nigeria and Pakistan (more than half) and India (more than two-thirds) thought that it was not necessary to deliver in a hospital or clinic. This finding corroborates with a study in Indonesia where the preference for traditional birth attendants was strongly affected by traditional belief [39].

Several studies found that women living far away from a health facility were much less likely to have a skilled attendant and an institutional delivery [4, 17]. In this study, distance and lack of transport were the most important reason for the nonuse of health services for delivery in Kenya and Tanzania and the second most important reason in Nigeria.

TABLE 4: Percent citing each reason for not delivering at a health facility by country.

Reason for not delivering at a health facility	Kenya	Nigeria	Tanzania	India	Pakistan
Cost too much	13.8	9.6	6.6	22.1	38.6
Facility not open	5.4	5.2	1.0	3.5	5.8
Too far/no transport	45.1	23.5	33.7	12.2	6.6
Do not trust facility	3.0	2.0	1.5	2.6	3.9
No female provider	1.7	1.3	1.0	1.1	0.8
Husband/family did not allow	1.6	4.6	1.9	5.0	7.2
Not necessary	22.3	54.9	19.2	69.6	54.1
Not customary	2.0	11.5	8.1	5.3	6.6
Abrupt delivery	16.1	—	—	—	5.5
Other	5.1	6.9	30.4	3.6	1.9
Mean number of reasons	1.16	1.20	1.03	1.25	1.31

TABLE 5: Percent of women citing each reason for not delivering at a health facility by ethnicity, Pakistan.

Reason for not delivering at a health facility	Cost too much	Too far	Husband/family did not allow	Thought it was not necessary
Ethnicity				
Urdu	31.3	3.0	5.1	57.6
Punjabi	31.6	3.3	3.0	68.4
Sindhi	48.0	5.7	5.9	50.8
Pushto	31.8	6.5	13.3	42.1
Balochi	44.0	19.9	11.6	48.1
Barauhi	32.1	8.6	16.0	59.3
Siraiki	46.5	7.5	5.0	57.0
Hindko	43.2	3.4	3.4	47.7
Kashmiri	0.0	0.0	0.0	100.0
Pahari	25.0	25.0	0.0	25.0
Potowari	100.0	0.0	100.0	0.0
Marwari	56.3	3.1	0.0	50.0
Farsi	0.0	0.0	0.0	66.7
Other	53.2	10.5	5.6	46.0

High cost was the second most often stated reason for the nonuse of health services in India and Pakistan. However, it was of lesser concern to women from the three African countries, especially Tanzania.

It is notable that a rather sizable proportion of nonusers of health services in Kenya mentioned abrupt delivery, and more than one in ten in Nigeria reported that it was not customary to give birth in a health facility. Other barriers to institutional delivery include objection from husband/family (especially in Pakistan), no facility, and lack of trust in the facility. Only a small proportion mentioned nonavailability of female health provider for not delivering at a health facility.

More detailed tabulations of data show the very wide variations of reasons for the nonuse of health facility for delivery by region and ethnicity within each country. For instance, in India the proportion of respondents who mentioned "cost too much" ranged from none in Kerala to 48 percent in Bihar; the percentage not using a health facility for delivery because of distance ranged from 4.7 percent in Delhi to 75 percent in Kerala; family objections ranged from none in Kerala to 17.5 percent in West Bengal and "not necessary to use" ranged from 25 percent in Kerala to more than three-quarters in a number of districts.

The ethnic differentials in the reasons for not using a health facility for delivery were most striking in Pakistan, as shown in Table 5. The percentage that did not use the health services for delivery because of high cost, objection from husband/family, and "not necessary" ranged from none to 100 percent. It is noteworthy that all Potowari women did not use a health service for delivery due to the objection from husband or family.

4. Discussion

Between 1990 and 2010, maternal mortality ratio (MMR) declined by 64 percent in Southern Asia and 41 percent in Sub-Saharan Africa. The MMR in these two regions remains the highest in the world, and it appears unlikely for Sub-Saharan Africa to achieve the target under MDG 5 to reduce the MMR by three-quarters between 1990 and 2015. Because the majority of maternal deaths occur just before, during, or just after delivery, often from complications that cannot be predicted, institutional delivery can reduce the risk of complications and death of mother and baby significantly. Nonetheless, a very high proportion of births in Sub-Saharan African and Southern Asia are occurring outside a health

facility and are not delivered by a skilled attendant. Concerted efforts must be made to increase the utilization of maternal care services to achieve the MDG goals in the two regions.

Consistent with the findings of previous research [2, 10, 12, 23, 24, 27, 37, 38, 40], our analysis shows that in all the six countries in this study, women's education, household wealth, and urban-rural residence had the most significant and consistent effects on the utilization of health services for delivery. Higher education is generally associated with urban living, higher income, and better exposure to the media, all of which affect the use of health facilities for childbirth [2, 10, 12, 27, 31, 32, 35, 41]. Our findings corroborate with the findings of previous studies on these aspects.

Urban-rural differentials in health care utilization were due to the concentration of health infrastructure and personnel in urban areas [42]. There is a need for alternative strategies to reach those living in remote areas, including the use of mobile units.

Although primary school enrolments have increased dramatically in Sub-Saharan Africa and South Asia, these regions are still lagging behind in education. Of the 72 million out-of-school children worldwide, nearly half reside in Sub-Saharan Africa [43]. Less developed countries need to invest more in education and give equal opportunities to the girls and the lower socioeconomic groups. Investing in education will facilitate gender equity and women's empowerment and their labor force participation. Educational improvement will bring about a rise in income level, which in turn will lead to increased utilization of health services towards achieving the MDG goal of improving maternal health. The experience of low-resource Ethiopia in putting three million more children in school than in 2000 with a rural school construction programme and abolition of primary school fees could serve as a good lesson for others [43].

The family wealth index was found to be the most important predictor of the use of institutional delivery. Hence, the high cost of health services (of much concern in India and Pakistan) and the inability of the poor to pay would pose as a serious barrier to the use of health facilities for delivery. Programs and strategies aimed at removing financial barriers in some countries have been found to be effective in increasing the utilization of delivery care services [44, 45].

Past studies found that women who had a say in their own health care were more likely to use a health facility for health care, including delivery [33, 34, 46, 47]. In Yemen, underutilization of modern delivery care was attributed to women's low autonomy and status [25]. Contrary to these studies, our findings show that whether or not a woman had a say in her own health care had little effect on institutional delivery.

Lack of exposure to media also posed as a barrier to the utilization of maternal and child health services [16]. Our finding suggests that the nonuse of a health facility could probably be due to the lack of knowledge or information on the importance of giving birth in a health facility and the location of such facilities. The low media exposure among women in Sub-Saharan Africa and South Asia could be partly due to their low educational level and the lack of media facilities and reports. Hence, concerted efforts should be made to use the mass media more effectively to disseminate the benefits and

importance of institutional delivery and the risks of not using these services. Reproductive health education should be incorporated into the school curriculum. Countries may also learn from the successes of the community-based safe motherhood intervention in Tanzania that has proven to be very effective in promoting the utilization of obstetric care and a skilled attendant at delivery [17]. Users of health services could be encouraged to serve as agents to motivate others in their own community to make use of health facilities for delivery.

The likelihood of institutional delivery decreased with the number of children, as women may feel more confident and feel that there is no need for institutional delivery. There is therefore a need to inform women of the increased risk of the complications of higher order pregnancies and older maternal age and to encourage them to continue using the health services for subsequent births.

Barriers to the use of health facilities for delivery varied widely across and within a country. Service related factors such as cost (not affordable), distance/lack of transport, and availability were the main barriers to institutional delivery in Kenya and Pakistan, while sociocultural factors, especially the perception that there was no need to use the health services for delivery, were the main reasons for noninstitutional delivery in India, Nigeria, and Tanzania. Hence, appropriate strategies need to be implemented to remove these barriers by the respective countries to reduce the unmet need for services for specific target groups, especially the poor and those living in remote areas.

Cultural beliefs and practices and the lack of awareness and knowledge often pose as barriers to the utilization of health services for delivery [4, 15, 17, 23, 36, 48–51]. Many women and their husbands may not realize the various risk factors associated with pregnancy and delivery. More information, education, and motivation programs and campaigns should be held to reach out to the public, including the males.

The private sector plays a very important role in maternal care services, especially in Pakistan and India. However, services provided by the private sector were not so accessible to the poor because of the higher cost. Hence, there is a need to form a strong public-private partnership in delivering the health services. Private hospitals and doctors should be encouraged to play their role in fulfilling their corporate social responsibilities. Besides, the government could consider providing some forms of incentives such as tax rebate and subsidies to private doctors to make their services more readily available and accessible to the poor. More efforts should be made to engage the private hospitals and doctors in the national health programs.

More than half of the births in South Asia and Sub-Saharan Africa are delivered by traditional birth attendants and other untrained attendants. Delivery by untrained attendant is probably the main reason for the high maternal mortality in the regions, as traditional birth attendants are neither ready to handle complications during and after delivery nor do they have the necessary equipment and medicine to treat hemorrhage (uncontrolled bleeding), sepsis (infection), and hypertensive disorders, which are the main causes of maternal death. The services of traditional birth attendants

will continue to be sought after in the foreseeable future, and hence, there is a need to give them the necessary support and equip them with the necessary skills, including basic knowledge and information on HIV/AIDS. Further, traditional birth attendants should be encouraged and given some incentives to refer their clients to the hospitals and clinics.

A previous study found that young women who initiated antenatal care were more likely to use skilled professional assistance at delivery than their counterparts who initiated antenatal care later [28]. Women should be informed of the importance of initiating antenatal checks during the first trimester and informed of the importance and benefits of institutional delivery during their antenatal visits.

Of the six countries in this study, Bangladesh had the lowest hospital bed-population ratio at 3 per 10,000 population, while Kenya and India had a relatively higher ratio at 14 and 9 per 10,000 population, respectively [9]. There is therefore a need for the governments to allocate more resources to the health sector to make health services widely accessible, including the remote rural areas, and to train and recruit more health personnel. The governments can consider giving free maternal care, as in the case of Ghana [44], provide vouchers such as in Cambodia [45], or make other arrangements to promote institutional delivery among the poor. In some countries, increasing ambulance services may be necessary to bring patients to the health facilities, as many had cited lack of transportation as the main reason for not using a health facility for delivery.

5. Conclusion

Despite making substantial progress towards improving maternal health, many countries in South Asia and Sub-Saharan Africa are still grappling with the problems of high maternal mortality and are struggling to achieve the Millennium Development Goals (MDG) to reduce the MMR by three-quarters by 2015. Given the low institutional delivery and high maternal mortality in the regions, there is a need to target the groups who do not use health services for delivery and address the barriers that exist. Besides removing the service-related barriers, public health information and education need to be widely disseminated to influence the public opinion on the benefits and the importance of health care utilization. The successes and good practices of some countries in implementing various policies and programs to increase institutional delivery could serve as models for other developing countries. The effective implementation of programs and strategies directed at specific target groups requires the involvement of various stakeholders to remove the barriers to the utilization of maternal care services.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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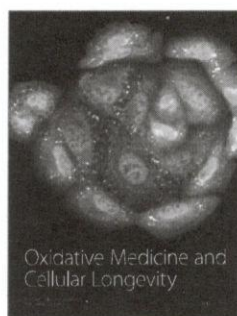
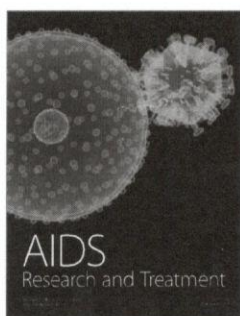
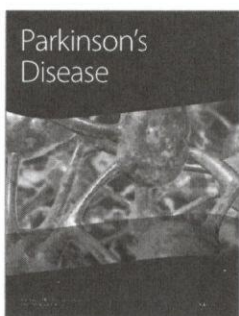
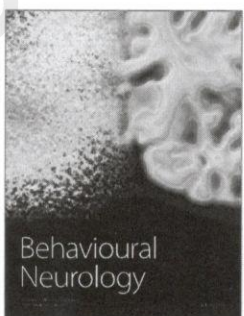
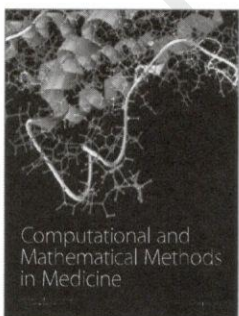
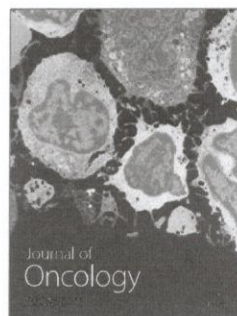
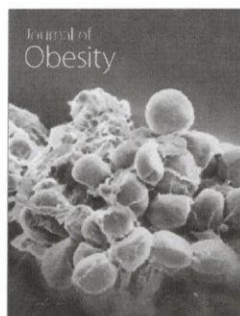
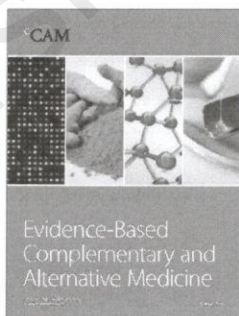
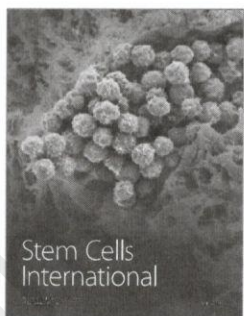
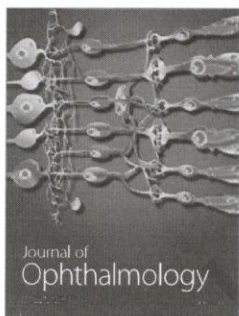
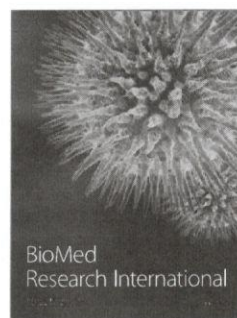
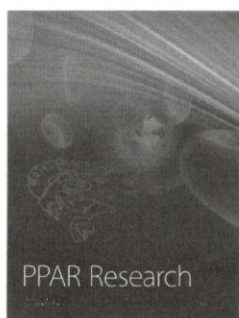
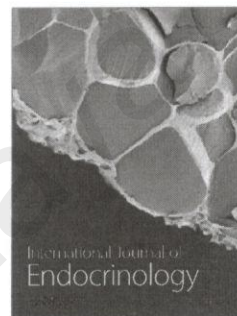
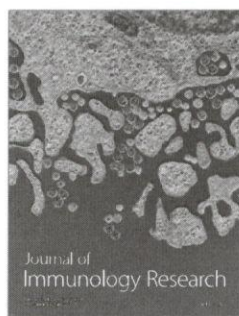
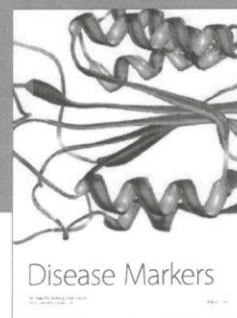
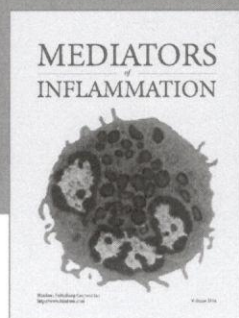
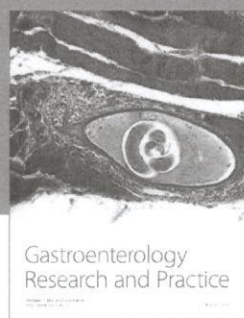
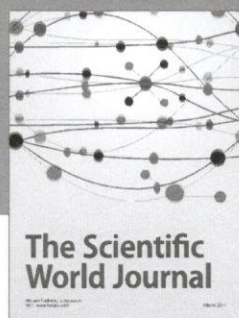
References

- [1] World Health Organization, "Trends in maternal mortality: 1990 to 2010," Tech. Rep., WHO, UNICEF, UNFPA and The World Bank Estimates, Geneva, Switzerland, 2012.
- [2] P. Govindasamy and B. M. Ramesh, "Maternal education and the utilization of maternal and child health services in India," National Family Health Survey Subject Reports no. 5, International Institute for Population Sciences, Mumbai, India, 1997.
- [3] F. Khatun, S. Rasheed, A. C. Moran et al., "Causes of neonatal and maternal deaths in Dhaka slums: implications for service delivery," *BMC Public Health*, vol. 12, no. 1, article 84, 2012.
- [4] M. Mälqvist, N. Sohel, T. T. Do, L. Eriksson, and L.-Å. Persson, "Distance decay in delivery care utilisation associated with neonatal mortality. a case referent study in northern Vietnam," *BMC Public Health*, vol. 10, article 762, 2010.
- [5] J. L. Alvarez, R. Gil, V. Hernández, and A. Gil, "Factors associated with maternal mortality in Sub-Saharan Africa: an ecological study," *BMC Public Health*, vol. 9, article 462, 2009.
- [6] Medecins Sans Frontieres, "Urgent delivery maternal death: the avoidable crisis," Tech. Rep., 2012.
- [7] "Maternal mortality," in *Fact Sheet*, M. Centre, Ed., no. 348, World Health Organization, Geneva, Switzerland, 2012.
- [8] "Maternal and newborn health," Young Child Survival and Development, The United Nations Children's Fund (UNICEF), 2012.
- [9] "World development indicators," Tech. Rep., The World Bank, Washington, DC, USA, 2010.
- [10] S. Agha and T. W. Carton, "Determinants of institutional delivery in rural Jhang, Pakistan," *International Journal for Equity in Health*, vol. 10, article 31, 2011.
- [11] R. Amin, N. M. Shah, and S. Becker, "Socioeconomic factors differentiating maternal and child health-seeking behavior in rural Bangladesh: a cross-sectional analysis," *International Journal for Equity in Health*, vol. 9, article 9, 2010.
- [12] T. R. Jat, N. Ng, and M. San Sebastian, "Factors affecting the use of maternal health services in Madhya Pradesh state of India: a multilevel analysis," *International Journal for Equity in Health*, vol. 10, article 59, 2011.
- [13] M. Wellhoner, A. C. C. Lee, K. Deutsch et al., "Maternal and child health in Yushu, Qinghai Province, China," *International Journal for Equity in Health*, vol. 10, article 42, 2011.
- [14] K. Lhamsuren, T. Chojiljav, E. Budbazar, S. Vanchinkhuu, D. Chang Blanc, and J. Grundy, "Taking action on the social determinants of health: improving health access for the urban poor in Mongolia," *International Journal for Equity in Health*, vol. 11, p. 15, 2012.
- [15] K. Navaneetham and A. Dharmalingam, "Utilization of maternal health care services in Southern India," *Social Science and Medicine*, vol. 55, no. 10, pp. 1849–1869, 2002.
- [16] S. Kistiana, *Socio-economic and demographic determinants of maternal health care utilization in Indonesia*, Faculty of Social Sciences, The Flinders University of South Australia, Adelaide, Australia, 2009.

- [17] R. N. Mpembeni, J. Z. Killewo, M. T. Leshabari et al., "Use pattern of maternal health services and determinants of skilled care during delivery in Southern Tanzania: implications for achievement of MDG-5 targets," *BMC Pregnancy and Childbirth*, vol. 7, article 29, 2007.
- [18] C. Wanjira, M. Mwangi, E. Mathenge, G. Mbugua, and Z. Ng'Ang'A, "Delivery practices and associated factors among mothers seeking child welfare services in selected health facilities in Nyandarua South District, Kenya," *BMC Public Health*, vol. 11, article 360, 2011.
- [19] Y. Celik and D. R. Hotchkiss, "The socio-economic determinants of maternal health care utilization in Turkey," *Social Science and Medicine*, vol. 50, no. 12, pp. 1797–1806, 2000.
- [20] S. Crowe, M. Utley, A. Costello, and C. Pagel, "How many births in sub-Saharan Africa and South Asia will not be attended by a skilled birth attendant between 2011 and 2015?" *BMC Pregnancy and Childbirth*, vol. 12, article 4, 2012.
- [21] M. A. Magadi, A. O. Agwanda, and F. O. Obare, "A comparative analysis of the use of maternal health services between teenagers and older mothers in sub-Saharan Africa: evidence from Demographic and Health Surveys (DHS)," *Social Science and Medicine*, vol. 64, no. 6, pp. 1311–1325, 2007.
- [22] "Quality information to plan, monitor, and improve population, health, and nutrition programs," Demographic and Health Surveys, ICF Macro, Calverton, New York, USA, 2009.
- [23] N. Chakraborty, M. A. Islam, R. I. Chowdhury, W. Bari, and H. H. Akhter, "Determinants of the use of maternal health services in rural Bangladesh," *Health Promotion International*, vol. 18, no. 4, pp. 327–337, 2003.
- [24] S. Ahmed, A. A. Creanga, D. G. Gillespie, and A. O. Tsui, "Economic status, education and empowerment: implications for maternal health service utilization in developing countries," *PLoS One*, vol. 5, no. 6, Article ID e11190, 2010.
- [25] A. Kempe, F. N. A. Alwazer, and T. O. Theorell, "The role of demand factors in utilization of professional care during childbirth: perspectives from Yemen," *ISRN Obstetrics and Gynecology*, vol. 2011, Article ID 382487, 12 pages, 2011.
- [26] S. Babalola and A. Fatusi, "Determinants of use of maternal health services in Nigeria—Looking beyond individual and household factors," *BMC Pregnancy and Childbirth*, vol. 9, article 1471, p. 43, 2009.
- [27] E. Zere, D. Oluwole, J. M. Kirigia, C. N. Mwikisa, and T. Mbeeli, "Inequities in skilled attendance at birth in Namibia: a decomposition analysis," *BMC Pregnancy and Childbirth*, vol. 11, article 34, 2011.
- [28] R. Ochako, J.-C. Fotso, L. Ikamari, and A. Khasakhala, "Utilization of maternal health services among young women in Kenya: insights from the Kenya Demographic and Health Survey, 2003," *BMC Pregnancy and Childbirth*, vol. 11, article 1, 2011.
- [29] S. Gabrysch and O. M. Campbell, "Still too far to walk: literature review of the determinants of delivery service use," *BMC Pregnancy and Childbirth*, vol. 9, article 34, 2009.
- [30] S. Raghupathy, "Education and the use of maternal health care in Thailand," *Social Science and Medicine*, vol. 43, no. 4, pp. 459–471, 1996.
- [31] I. Addai, "Demographic and sociocultural factors influencing use of maternal health services in Ghana," *African Journal of Reproductive Health*, vol. 2, no. 1, pp. 73–80, 1998.
- [32] I. Addai, "Determinants of use of maternal-child health services in rural Ghana," *Journal of Biosocial Science*, vol. 32, no. 1, pp. 1–15, 2000.
- [33] K. Allendorf, "Couples' reports of women's autonomy and health-care use in Nepal," *Studies in Family Planning*, vol. 38, no. 1, pp. 35–46, 2007.
- [34] M. Furuta and S. Salway, "Women's position within the household as a determinant of maternal health care use in Nepal," *International Family Planning Perspectives*, vol. 32, no. 1, pp. 17–27, 2006.
- [35] B. Owino, "The use of maternal health care services: socio-economic and demographic factors—Nyanza, Kenya," *L'Institut Français de Recherche en Afrique, IFRA, Les Cahiers*, vol. 21, pp. 81–122, 2001.
- [36] M. Palamuleni, "Determinants of non-institutional deliveries in Malawi," *Malawi Medical Journal*, vol. 23, no. 4, pp. 104–108, 2011.
- [37] A. Shariff and G. Singh, "Determinants of maternal health care utilisation in India: evidence from a recent household survey," Working Paper, Registrar and Secretary, National Council of Applied Economic Research, New Delhi, India, 2002.
- [38] G. Woldemicael, "Do women with higher autonomy seek more maternal and child health-care? evidence from Ethiopia and Eritrea," MPIDR Working Paper WP 2007-035, Max Planck Institute for Demographic Research, Rostock, Germany, 2007.
- [39] Y. Agus and S. Horiuchi, "Factors influencing the use of antenatal care in rural West Sumatra, Indonesia," *BMC Pregnancy and Childbirth*, vol. 12, article 9, 2012.
- [40] H. Bashour, A. Abdulsalam, W. Al-Faisal, and S. Cheikha, "Patterns and determinants of maternity care in Damascus," *Eastern Mediterranean Health Journal*, vol. 14, no. 3, pp. 595–604, 2008.
- [41] M. Rahman, S. E. Haque, M. G. Mostofa, L. Tarivonda, and M. Shuaib, "Wealth inequality and utilization of reproductive health services in the Republic of Vanuatu: insights from the multiple indicator cluster survey, 2007," *International Journal for Equity in Health*, vol. 10, article 58, 2011.
- [42] A. V. Patil, K. V. Somasundaram, and R. C. Goyal, "Current health scenario in rural India," *The Australian Journal of Rural Health*, vol. 10, no. 2, pp. 129–135, 2002.
- [43] United Nations Educational, "Goal 2: achieve universal primary education," 2013.
- [44] E. A. Opoku, *Utilization of maternal care services in Ghana by region after the implementation of the free maternal care policy [thesis]*, School of Public Health, University of North Texas Health Science Center, Fort Worth, Tex, USA, 2009.
- [45] P. Ir, D. Horemans, N. Souk, and W. Van Damme, "Using targeted vouchers and health equity funds to improve access to skilled birth attendants for poor women: a case study in three rural health districts in Cambodia," *BMC Pregnancy and Childbirth*, vol. 10, article 1, 2010.
- [46] S. Breen and T. Ensor, "Contextual influences and individual determinants of skilled attendance at delivery in Zambia: a multivariate analysis of the 2007 demographic and health survey," The Mobilizing Access to Maternal Health Services in Zambia Programme, Health Partners International, Lusaka, Zambia, 2011.
- [47] J. Espey and N. Dolata, *An Equal Start. Why Gender Equality Matters for Child Survival and Maternal Health*, Save the Children UK, London, UK, 2011.
- [48] G. Letamo and S. D. Rakgoasi, "Factors associated with non-use of maternal health services in Botswana," *Journal of Health Population and Nutrition*, vol. 21, no. 1, pp. 40–47, 2003.

- [49] K. Dalal and S. Dawad, "Non-utilization of public health care facilities: examining the reasons through a national study of women in India," *Rural and Remote Health*, vol. 9, no. 3, pp. 1178–1187, 2009.
- [50] W. A. Gazali, F. Muktar, and M. M. Gana, "Barriers to utilization of maternal health care facilities among pregnant and non-pregnant women of child bearing age in Maiduguri Metropolitan Council (MMC) and Jere Lgas of Borno State," *Continental Journal of Tropical Medicine*, vol. 6, no. 1, pp. 12–21, 2012.
- [51] S. Das, U. Bapat, N. S. More, L. Chordhekar, W. Joshi, and D. Osrin, "Prospective study of determinants and costs of home births in Mumbai slums," *BMC Pregnancy and Childbirth*, vol. 10, article 38, 2010.

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Ethnic and Gender Differentials in Non-Communicable Diseases and Self-Rated Health in Malaysia

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Abstract

Objectives: This paper examines the ethnic and gender differentials in high blood pressure (HBP), diabetes, coronary heart disease (CHD), arthritis and asthma among older people in Malaysia, and how these diseases along with other factors affect self-rated health. Differentials in the prevalence of non-communicable diseases among older people are examined in the context of socio-cultural perspectives in multi-ethnic Malaysia.

Methods: Data for this paper are obtained from the 2004 Malaysian Population and Family Survey. The survey covered a nationally representative sample of 3,406 persons aged 50 and over, comprising three main ethnic groups (Malays, Chinese and Indians) and all other indigenous groups. Bivariate analyses and hierarchical logistic regression were used in the analyses.

Results: Arthritis was the most common non-communicable disease (NCD), followed by HBP, diabetes, asthma and CHD. Older females were more likely than males to have arthritis and HBP, but males were more likely to have asthma. Diabetes and CHD were most prevalent among Indians, while arthritis and HBP were most prevalent among the Indigenous groups. Older people were more likely to report poor health if they suffered from NCD, especially CHD. Controlling for socio-economic, health and lifestyle factors, Chinese were least likely to report poor health, whereas Indians and Indigenous people were more likely to do so. Chinese that had HBP were more likely to report poor health compared to other ethnic groups with the same disease. Among those with arthritis, Indians were more likely to report poor health.

Conclusion: Perceived health status and prevalence of arthritis, HBP, diabetes, asthma and CHD varied widely across ethnic groups. Promotion of healthy lifestyle, early detection and timely intervention of NCDs affecting different ethnic groups and gender with socio-cultural orientations would go a long way in alleviating the debilitating effects of the common NCDs among older people.

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Introduction

One of the major challenges of population aging is meeting the healthcare needs of rapidly increasing number of older persons suffering from various health problems. Non-communicable diseases (NCDs) are the most common health problems, and are the primary causes of death in many countries. Cardiovascular diseases, cancers, chronic respiratory diseases and diabetes are the top four NCDs which have resulted in highest number of deaths, especially in low and middle-income countries [1]. NCD patients suffer health and physical limitations and are also burdened by the costly treatment of these diseases [1,2]. Complications from NCDs such as diabetes are costly to treat, and are rarely curable [3].

Unhealthy lifestyles and diet such as tobacco use, lack of physical activity, poor diet and excessive use of alcohol increase the risk of NCDs [1,2]. Certain diseases tend to be more prevalent among some ethnic groups. For instance, high blood pressure is more common among Blacks in a Western population, and

diabetes and cardiovascular diseases are more prevalent among Indians [4,5].

The single-item indicator of self-rated health is often used to indicate the overall health status of individuals [6,7,8]. Despite its simplicity, it is inherently a multidimensional concept capturing dimensions of physical, functional, coping and well-being [9,10]. Several studies have focused on factors affecting health assessments. Chronic diseases, chronic pain and physical disability are significant predictors of self-rated health [11,12,13,14]. Perceived health also varies according to age, gender, ethnicity, education, income, unemployment, and lifestyle factors such as smoking and physical inactivity [15,16,17,18,19,20]. The ethnic differentials in health assessments have rarely been addressed, particularly in low and middle-income countries. Several studies found that poor self-rated health is closely associated with mortality, especially among the elderly [21,22,23,24]. Hence, there has been growing interest in the study of self-rated health as an indicator for the health status of a population.

Multi-ethnic Malaysia provides an excellent setting for a study on the differentials of health problems of older people, from a sociocultural perspective. Malaysia is a South-east Asian, middle-income nation. The western parts (Peninsular Malaysia) and the eastern parts (Sabah and Sarawak) are separated by South China Sea. Of a total population of 28.3 million in 2010, the Malays made up 55%, Chinese 24%, Indians 7%, other Indigenous people 13% and others 1%. The Malays, Chinese and Indians are the predominant ethnic groups in Peninsular Malaysia, whereas Indigenous groups are mostly from the states of Sabah and Sarawak in East Malaysia [25]. Ethnic groups in Malaysia have diverse cultures, religions and background characteristics [26]. Islam is the national religion. All Malays are Muslim, 75.9% of the Chinese are Buddhist and 9.6% are Christian, 84.5% of the Indians are Hindu and 7.7% are Christian, and about half of the Indigenous people are Christian and 36.3% are Muslim [27]. Thus, a comparison among these ethnic groups may reveal socio-cultural differentials in illness patterns.

The objectives of this study are to examine 1) the ethnic and gender differentials in the prevalence of selected NCDs, and 2) the impact of NCDs and other factors affecting poor self-rated health, among older persons within a multi-ethnic setting. A better understanding of the ethnic and gender differentials in NCDs and poor self-rated health is needed to target high risk groups in the provision of services, and to arrest the growing burden of NCDs. This study also seeks to contribute to the literature on the health differentials across the 3 largest ethnic groups in the world, i.e., the Malays, Chinese and Indians.

Methods

Ethics Statement

This study utilized survey data collected by the National Population and Family Development Board (NPFDB) of Malaysia (<http://www.lppkn.gov.my/index.php?lang=en>). With the approval of the director general of NPFDB, we signed a Terms of Reference Contract and were given permission by the Research Committee of the NPFDB to use the data for research and publication. The survey was conducted according to the existing laws and regulations, and data has already been de-identified by NPFDB. Therefore we were exempted from obtaining ethical approval.

Data Sources

Data for this study are taken from the 2004 Malaysian Population and Family Survey (MPFS-4). The MPFS-4 was conducted in 2004 by the NPFDB, under the purview of the Ministry of Women, Family and Community Development of Malaysia, with funding from the Economic Planning Unit and technical assistance in sample selection from the Department of Statistics of Malaysia. The MPFS-4 sample was selected using a stratified multistage sampling design, and the survey was fielded between July 2004 and September 2004. The Kish method was used in the selection of senior citizens within the selected households. Participants gave oral consent and face-to-face interviews were conducted by trained personnel. The MPFS was conducted decennially since 1974. The 2004 MPFS was the first covering Peninsular Malaysia, Sabah and Sarawak [28,29,30]. This study is confined to Malaysian citizens aged 50 and above.

Measures

Self-rated health. The 3-category self-rated health variable (1 = *Good*, 2 = *Average*, 3 = *Poor*) was recoded into a binary variable

to indicate poor health (0 = *Good or average health assessment*, 1 = *Poor health assessment*).

NCDs. Respondents were asked if they were suffering from 5 types of diseases: 1) high blood pressure (HBP), 2) diabetes, 3) coronary heart disease (CHD), 4) arthritis, and 5) asthma. Responses for each of these diseases were coded as binary variables (0 = *No*, 1 = *Yes*).

Physical limitations. Respondents were asked if they were unable to perform a list of tasks: 1) feed oneself, 2) bath unassisted, 3) get dressed unassisted, 4) go to the toilet unassisted, 5) exercise, 6) do housework, 7) attend religious gatherings, and 8) grocery shopping. The number of physical limitations were totaled and recoded into a 3-category variable (1 = *none*, 2 = *"1 or 2 limitations"*, 3 = *"3 or more limitations"*).

Demographic variables. Demographic variables include respondent's age (1 = 50–59 years, 2 = 60–69 years, 3 = 70+ years), gender (0 = *Female*, 1 = *Male*), ethnicity (1 = *Malay*, 2 = *Chinese*, 3 = *Indian*, 4 = *Indigenous*), marital status (0 = *Unmarried*, 1 = *Married*) and place of residence (0 = *Rural*, 1 = *Urban*). Respondents who were widowed, divorced, separated, or never married were categorized as unmarried.

Socio-economic status (SES). Variables reflecting respondent's SES include education (1 = *None*, 2 = *Primary*, 3 = *Secondary and above*), current work/employment status (0 = *Not working*, 1 = *Working*), and number of other income sources (1 = *0 source*, 2 = *1 or 2 sources*, 3 = *3 or more sources*). In the survey, respondents were asked if they had any inheritance (house, company, land, etc.), savings in the Employees Provident Fund (a defined-contribution public pension plan), pension, rewards/remunerations, savings in bank, savings in 'tabung haji' (the Malaysian haji pilgrims fund board), share investments and insurance. These sources of income were totaled and recoded into a 3-category variable.

Lifestyle factors. Variables indicating lifestyle factors include exercise (1 = *never*, 2 = *1 to 3 times a week*, 3 = *4 or more times a week*), and smoking/tobacco use (1 = *Non-smoker*, 2 = *Previous smoker*, 3 = *Current smoker*).

Statistical Analysis

We began by examining the ethnic differentials in demographic, socio-economic, lifestyle and health characteristics, with tests of association between ethnicity and these variables. This was followed by an examination of the prevalence of the 5 diseases (HBP, diabetes, CHD, arthritis and asthma) according to ethnicity, gender and age of respondents. As the independent variables are inter-related, separate binary logistic regressions [31] were carried out to examine net effects of ethnicity, gender, age and socio-economic variables on each NCD at $p < 0.05$. Finally, hierarchical binary logistic regression [31] was run to examine the impact of NCDs, and demographic, socio-economic and lifestyle factors, affecting self-rated health. Age, gender, ethnicity, marital status and place of residence were entered into the model in the first step, socio-economic variables in the second step, physical limitations and NCDs in the third step and lifestyle factors in the fourth step. Two-way interaction terms between ethnicity and each disease were tested and assessed through likelihood ratio tests at $p < 0.05$. The final model with significant interaction terms were confirmed through Wald statistics. In multivariate analyses, we weighted the dataset to reflect the population distribution of Malays, Chinese, Indians and Indigenous groups [25]. Data were analyzed using SPSS for Windows version 19.

Odds ratio greater than 1 is interpreted as how many times an event was more likely to occur, compared to the reference group. For odds ratio of less than 1, its inverse is interpreted as how many

times an event is less likely to occur as compared to the reference group.

Results

The sample of 3,406 respondents consisted of 46% Malays, 25% Chinese, 5% Indians and 24% Indigenous people (Table 1). The majority of respondents were in their 50 s–60 s (80.6%). Females made up 66.2% of the sample, and 61.6% were currently married. A little more than half (52.3%) were living in rural areas. Malays and Indigenous people were concentrated in rural areas whereas the Chinese and Indians were mainly from the urban areas. The majority had primary or no schooling (79.8%), and the proportion of respondents with no formal schooling was much higher among the Indigenous people. About one third of the Chinese and Indians had at least secondary education. About two thirds (63.9%) were not working and this percentage was significantly lower among the Indigenous people. Slightly more than three quarters (77.1%) had at least 1 source of income, with the Malays relatively more likely to have multiple sources of income. In terms of lifestyle habits, 61.3% did not exercise and 67.9% were non-smokers. Chinese and Indians were relatively more likely than Malays and Indigenous people to exercise more than 3 times a week, whereas the prevalence of smoking was highest among the Indigenous people. Health-wise, 82.7% reported good or average health. The Malays were more likely than the rest to have multiple physical limitations. The Chinese were more likely to report good health, whereas the Indians and Indigenous people were more likely to perceive themselves to be in poor health. Except for age, significant associations were found between ethnicity and all other variables.

The overall prevalence of the 5 NCDs reported by respondents in this study was 35.8% for HBP, 14.1% for diabetes, 8% for CHD, 45.3% for arthritis and 13.2% for asthma (Table 2). Indigenous people were more likely than others to suffer from HBP, arthritis and asthma, while the Indians had the highest prevalence in diabetes and CHD. The prevalence of HBP, CHD, arthritis and asthma increased monotonically with age. However, the prevalence of diabetes was highest for those aged 60–69 among the females, Malays, Indians and Indigenous groups (data not shown). Other anomalies related to age and disease were: 1) CHD – higher prevalence among those aged 60–69 than those aged 70+ among Indians, 2) arthritis – highest prevalence among those aged 60–69 for the Malays, and decreased prevalence with advancing age among the Indians; and 3) asthma – decreasing prevalence with advance in age among the Indians (data not shown). Males were more likely than females to have diabetes, CHD and asthma, while the reverse was true for HBP and arthritis. With the exception of the Chinese, females were more likely than males to have HBP.

The odds of having each of the diseases are influenced by a multitude of factors (Table 3). As expected, the health problems tended to increase with advance in age. Respondents aged 70 and over were more likely than those aged 50–59 to suffer from HBP, CHD and arthritis, by as much as 1.3 times, 2.3 times and 1.7 times respectively. Males were less likely than females to suffer from HBP and arthritis, but more likely to suffer from asthma. There were also marked ethnic differentials in all 5 diseases. Indigenous people were 1.5 times more likely than the Malays to have HBP and arthritis, but they were 2.1 times less likely than the Malays to have diabetes. Compared to the Malays, Chinese were 1.6 times and 2 times less likely to have arthritis and asthma respectively, but Indians were 2.7 times and almost 4 times more likely to have diabetes and CHD respectively. Currently married

persons had significantly lower odds of having asthma as compared to the unmarried ($OR = 0.72$). The effect of urban place of residence was only significant in predicting the odds of diabetes ($OR = 1.32$). The effect of higher education was significant in reducing the odds of suffering from arthritis ($OR = 0.76$) and asthma ($OR = 0.62$). Currently working significantly reduced the odds of suffering from all 5 diseases. Those with multiple sources of income had higher odds of HBP ($OR = 1.38$) and CHD ($OR = 1.51$), as compared to those with no sources of income.

Demographic, socio-economic factors, physical limitations, NCDs and lifestyle factors were found to be significant predictors of self-rated health (Table 4). With just demographic variables in the model, age, ethnicity and place of residence significantly affected self-rated health. Respondents aged 70 and over were 3 times more likely than those aged 50–59 to report poor health. The Indians and Indigenous people were more likely than the Malays to report poor health, by as much as 2.2 times and 1.7 times respectively. Urban residents were 1.3 times less likely than their rural counterparts to report poor health. In the second model, all 3 SES variables were significant in predicting the odds of perceived poor health, controlling for demographic variables. Higher education and more sources of income reduced the odds of poor self-rated health. Respondents who were working were 1.9 times less likely than the non-working people to report poor health. The effect of age and ethnicity remained significant, but urban-rural differentials in self-rated health disappeared after taking into account other variables in the model. The gender differential in self-rated health became significant after controlling for SES variables – the males were 1.4 times more likely than the females to perceive themselves to be in poor health.

In the third model, the odds of poor self-rated health increased with the number of physical limitations. Respondents with 3 or more limitations were 2.5 times more likely to report poor health than those with no physical limitation. The odds of poor self-rated health were also higher in the presence of each of the 5 NCDs, with the odds ratios ranging from 1.4 to 2.9. Respondents suffering from CHD were almost 3 times more likely to report poor health than those without this disease. Controlling for other variables, the effects of gender, ethnicity and SES remained significant, but the effect of age had become insignificant. When lifestyle factors were included in the fourth model, only exercise was significant in predicting the odds of poor self-rated health. Respondents who exercised more than 3 times a week were 1.7 times less likely to report poor health, compared to those who did not exercise. The effects of gender, ethnicity, SES, physical limitations and the 5 diseases remained significant after taking into account lifestyle factors.

There were significant interactions between ethnicity and 2 diseases: HBP and arthritis. Therefore results on the effects of ethnicity were interpreted conditional upon these diseases. Chinese respondents who were suffering from HBP were more likely to report poor health, compared to Malays and other ethnic groups who were suffering from the similar disease. Among those suffering from arthritis, the Indians were more likely to report poor health than the rest. Controlling for these significant interactions, the effects of gender, SES, physical limitations and the 3 other diseases remained significant, with little changes in the odds ratios.

Discussion

NCDs are the major causes of mortality globally. In Malaysia, the Indian males who had the highest prevalence of life threatening diabetes had the lowest life expectancy. In 2010, life

Table 1. Characteristics of respondents according to ethnic groups.

Attributes	Ethnic Groups				Total n = 3406	Pearson Chi-square p value
	Malays n = 1554	Chinese n = 854	Indians n = 173	Indigenous n = 825		
Age						
50 s	46.0	46.6	53.8	42.4	45.7	0.125
60 s	35.3	33.7	31.2	36.1	34.9	
70 s +	18.7	19.7	15.0	21.5	19.4	
Gender						
Female	68.7	63.2	73.4	63.0	66.2	0.001
Male	31.3	36.8	26.6	37.0	33.8	
Marital status						
Unmarried	39.3	34.3	44.5	39.9	38.4	0.019
Married	60.7	65.7	55.5	60.1	61.6	
Residence						
Rural	59.1	21.7	20.8	77.9	52.3	<0.001
Urban	40.9	78.3	79.2	22.1	47.7	
Education						
No schooling	34.3	23.6	20.9	70.9	39.8	<0.001
Primary	47.3	44.3	43.6	21.1	40.0	
Secondary +	18.4	32.1	35.5	8.0	20.2	
Work status						
Not working	67.0	62.4	75.1	57.1	63.9	<0.001
Still working	33.0	37.6	24.9	42.9	36.1	
Other sources of income						
0 source	21.0	18.4	25.4	30.4	22.9	<0.001
1–2 sources	46.8	59.0	50.3	50.5	50.9	
3+ sources	32.2	22.6	24.3	19.0	26.2	
Exercise						
0 times	59.6	46.3	43.5	83.8	61.3	<0.001
1–3 times a week	21.4	23.1	25.9	12.3	19.8	
4+ times a week	19.0	30.6	30.6	3.9	18.8	
Smoker						
Non smoker	69.3	73.8	83.2	55.8	67.9	<0.001
Previous smoker	12.2	12.2	8.1	17.8	13.4	
Current smoker	18.5	14.1	8.7	26.4	18.8	
Physical limitations						
0 limits.	75.5	85.0	82.1	80.8	79.5	<0.001
1–2 limits.	14.4	9.5	9.8	12.7	12.5	
3+ limits.	10.2	5.5	8.1	6.4	8.0	
Self-rated health						
Good	39.5	54.2	36.4	33.3	41.5	<0.001
Average	45.0	34.4	38.7	41.6	41.2	
Poor	15.4	11.4	24.9	25.1	17.2	

expectancy at births among all males and females in Malaysia stood at 71.9 years and 77.0 years respectively while that for Indian males was only 68.0 years [32]. Hence, reducing NCDs will likely narrow the ethnic differentials in mortality and life expectancy.

Among the five NCDs examined in this study, arthritis was most common, followed by HBP, diabetes, asthma and CHD. The overall prevalence rate of arthritis and diabetes among older

Malaysians are rather close to the level in the developed countries such as the United States of America [3,33]. However, the overall prevalence of HBP among older Malaysians was still lower than that in USA which stood at around 60 to 70 percent for the period 1999–2008 [4,34].

Older Malaysian Indians had very high rate of diabetes, and they were much more likely than those from other ethnic groups to have this disease. These findings corroborate with other reports of

Table 2. Prevalence of 5 NCDs according to ethnicity, gender and age (percentage).

		HBP	Diabetes	CHD	Arthritis	Asthma
Overall		35.8	14.1	8.0	45.3	13.2
Age Group	50 s	30.8	12.9	5.4	39.7	10.1
	60 s	39.9	15.9	9.1	49.1	14.7
	70 s +	40.3	13.8	12.2	51.6	17.6
Gender	Female	37.7	14.0	7.9	50.5	11.5
	Male	32.2	14.4	8.4	35.2	16.3
Malay		34.3	15.5	7.1	46.7	13.7
	Female	38.1	15.2	6.7	51.4	11.7
	Male	25.7	16.4	8.0	36.7	18.1
Chinese		34.1	14.4	7.8	34.2	6.9
	Female	31.2	13.9	7.1	41.4	5.8
	Male	39.2	15.2	8.9	21.6	8.8
Indian		33.7	35.4	22.1	41.1	10.0
	Female	35.5	33.3	22.2	46.3	9.6
	Male	28.9	40.9	21.7	26.7	11.1
Indigenous		40.8	7.2	7.1	54.8	19.3
	Female	43.9	7.3	7.4	59.0	17.8
	Male	35.5	6.9	6.6	47.5	22.0

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higher prevalence in diabetes among people of Indian ethnic origin. Genetic susceptibility to diabetes, and urbanization which results in a sedentary lifestyle are several risk factors alluded to in these studies [5,35,36]. Age is also a likely factor in the case of type 2 diabetes [3]. A recent breakthrough in scientific research has suggested a link between type 2 diabetes and aging [37]. The study found that age-associated reductions in mitochondrial function can

cause muscle insulin resistance, which is a characteristic of the disease. Diabetes is also known to increase the risk of cardiovascular diseases [38]. Our findings show that Indians were also more likely than others to suffer from CHD.

Tobacco use is a probable cause of HBP and asthma. Indigenous groups and, to a lesser extent, the Malays tended to have smoking habits as compared to the Chinese and Indians.

Table 3. Logistic regression on selected NCDs (Odds ratios).

Variables	HBP	Diabetes	CHD	Arthritis	Asthma
Age group (ref: 50 s)					
60 s	1.40 (1.17, 1.67)	1.27 (1.00, 1.61)	1.89 (1.37, 2.60)	1.56 (1.31, 1.86)	1.16 (0.90, 1.50)
70 s +	1.32 (1.05, 1.67)	1.03 (0.75, 1.42)	2.31 (1.56, 3.43)	1.69 (1.34, 2.13)	1.15 (0.83, 1.58)
Male	0.80 (0.67, 0.97)	1.16 (0.90, 1.48)	1.04 (0.76, 1.42)	0.46 (0.38, 0.55)	2.03 (1.57, 2.62)
Ethnic (ref: Malay)					
Chinese	1.00 (0.83, 1.22)	0.86 (0.66, 1.11)	1.11 (0.79, 1.56)	0.62 (0.52, 0.75)	0.51 (0.37, 0.70)
Indian	0.94 (0.70, 1.26)	2.71 (1.98, 3.72)	3.89 (2.66, 5.70)	0.81 (0.60, 1.08)	0.80 (0.51, 1.25)
Indigenous	1.51 (1.20, 1.90)	0.47 (0.31, 0.70)	1.04 (0.67, 1.59)	1.52 (1.21, 1.91)	1.32 (0.98, 1.76)
Married	0.94 (0.79, 1.10)	1.07 (0.85, 1.34)	1.06 (0.79, 1.41)	1.16 (0.99, 1.37)	0.72 (0.57, 0.92)
Urban	1.12 (0.95, 1.33)	1.32 (1.05, 1.65)	1.09 (0.81, 1.45)	1.01 (0.86, 1.19)	0.89 (0.70, 1.14)
Education (ref: No schooling)					
Primary	1.04 (0.86, 1.25)	0.97 (0.75, 1.25)	0.97 (0.71, 1.33)	1.19 (0.99, 1.42)	0.79 (0.61, 1.02)
Secondary +	0.97 (0.76, 1.25)	1.00 (0.72, 1.39)	0.85 (0.55, 1.31)	0.76 (0.59, 0.98)	0.62 (0.42, 0.91)
Work	0.57 (0.48, 0.67)	0.57 (0.45, 0.73)	0.69 (0.50, 0.94)	0.81 (0.69, 0.95)	0.68 (0.53, 0.88)
Income sources (ref: 0)					
1-2	1.22 (1.01, 1.48)	0.94 (0.73, 1.22)	1.29 (0.92, 1.80)	1.16 (0.97, 1.39)	0.86 (0.66, 1.11)
3+	1.38 (1.09, 1.73)	1.21 (0.89, 1.64)	1.51 (1.01, 2.26)	1.22 (0.98, 1.53)	0.93 (0.68, 1.28)

Note: Figures in brackets show 95 percent confidence intervals. Odds ratio in bold indicate significance at 0.05.

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Table 4. Hierarchical logistic regression on poor self-rated health (Odds ratio).

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Age group (ref: 50 s)					
60 s	1.72 (1.35, 2.20)	1.31 (1.01, 1.70)	1.01 (0.77, 1.33)	1.01 (0.77, 1.33)	1.05 (0.80, 1.39)
70 s +	3.02 (2.29, 3.97)	1.86 (1.37, 2.52)	1.21 (0.85, 1.72)	1.21 (0.85, 1.73)	1.24 (0.87, 1.77)
Male	0.96 (0.76, 1.20)	1.43 (1.11, 1.85)	1.64 (1.24, 2.16)	1.48 (1.08, 2.05)	1.47 (1.06, 2.03)
Ethnic (ref: Malay)					
Chinese	0.79 (0.59, 1.04)	0.82 (0.61, 1.09)	0.93 (0.68, 1.26)	0.99 (0.73, 1.35)	0.59 (0.35, 0.99)
Indian	2.22 (1.57, 3.16)	2.29 (1.60, 3.29)	2.00 (1.34, 2.96)	2.12 (1.42, 3.16)	1.11 (0.56, 2.19)
Indigenous	1.71 (1.31, 2.24)	1.49 (1.13, 1.98)	1.46 (1.07, 1.97)	1.36 (1.00, 1.85)	0.82 (0.47, 1.43)
Married	0.91 (0.73, 1.14)	0.94 (0.75, 1.18)	0.94 (0.74, 1.19)	0.95 (0.74, 1.20)	0.93 (0.73, 1.18)
Urban	0.79 (0.63, 0.99)	0.85 (0.67, 1.07)	0.83 (0.64, 1.06)	0.86 (0.67, 1.10)	0.85 (0.66, 1.09)
Education (ref: No schooling)					
Primary		0.70 (0.55, 0.90)	0.72 (0.56, 0.94)	0.76 (0.58, 0.99)	0.77 (0.59, 1.01)
Secondary +		0.48 (0.33, 0.71)	0.53 (0.35, 0.78)	0.58 (0.39, 0.88)	0.60 (0.40, 0.91)
Work		0.54 (0.42, 0.70)	0.66 (0.51, 0.87)	0.65 (0.50, 0.86)	0.64 (0.49, 0.85)
Income sources (ref: 0)					
1–2		0.80 (0.63, 1.02)	0.77 (0.60, 0.99)	0.78 (0.61, 1.01)	0.78 (0.60, 1.00)
3+		0.59 (0.43, 0.81)	0.52 (0.37, 0.73)	0.54 (0.38, 0.77)	0.54 (0.38, 0.77)
Physical Limits (ref: 0)					
1–2			1.44 (1.05, 1.97)	1.40 (1.01, 1.92)	1.42 (1.03, 1.96)
3+			2.46 (1.70, 3.57)	2.29 (1.57, 3.34)	2.27 (1.55, 3.30)
HBP			1.40 (1.11, 1.76)	1.41 (1.12, 1.78)	1.15 (0.84, 1.58)
Diabetes			1.68 (1.27, 2.23)	1.73 (1.31, 2.29)	1.76 (1.32, 2.33)
CHD			2.90 (2.12, 3.96)	2.98 (2.17, 4.10)	2.90 (2.10, 4.00)
Arthritis			2.19 (1.75, 2.73)	2.18 (1.74, 2.72)	1.65 (1.22, 2.24)
Asthma			1.99 (1.51, 2.62)	1.92 (1.45, 2.54)	1.94 (1.47, 2.58)
Exercise (ref: 0 weekly)					
1–3 weekly				0.76 (0.56, 1.04)	0.77 (0.57, 1.05)
4+ weekly				0.60 (0.44, 0.83)	0.60 (0.43, 0.83)
Smoke (ref: Non-smoker)					
Previous smoker				1.28 (0.91, 1.79)	1.25 (0.89, 1.76)
Current smoker				1.21 (0.87, 1.68)	1.20 (0.86, 1.67)
Interaction effects					
HBP by Ethnic					
HBP by Chinese					2.09 (1.17, 3.76)
HBP by Indian					0.96 (0.43, 2.10)
HBP by Indigenous					1.45 (0.81, 2.59)
Arthritis by Ethnic					
Arthritis by Chinese					1.32 (0.74, 2.37)
Arthritis by Indian					3.32 (1.52, 7.24)
Arthritis by Indigenous					1.74 (0.95, 3.22)

Note: Figures in brackets show 95 percent confidence intervals. Odds ratio in bold indicate significance at 0.05.
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This may explain their higher likelihood of suffering from HBP and asthma. Lack of exercise may also contribute to the risk of HBP and arthritis among Indigenous groups, although there are other likely risks factors which need further investigation. Besides being predominantly rural, Indigenous groups are also disadvantaged in terms of socio-economic conditions. The Indigenous groups are lagging behind the others in educational attainment

and they are concentrated in the rural areas where health services are not as good as in the urban areas. Older Indigenous people are likely to have worked as low-skilled workers in rural sectors, and these posed as risk factors for higher prevalence of arthritis.

CHD has the strongest adverse effect on poor self-rated health, followed by arthritis, asthma, diabetes and HBP. This study finds that the older Chinese tended to report better health, and they

generally had lower prevalence of NCDs as compared to the other ethnic groups. Indians and Indigenous people were much more likely to report poor health, even after taking account SES, health and lifestyle variables. However, ethnic differentials in poor self-rated health were also found to be conditional upon certain diseases. Suffering from HBP was more debilitating to the Chinese, as compared to the other ethnic groups. On the other hand, older Indians were more likely than those from other ethnic groups to be adversely affected by arthritis.

Among those with HBP, cultural differentials may explain the higher propensity among Chinese to report poor health, as compared to other ethnic groups. Chinese, in general, have a preference for 'tastier' food containing high levels of sodium. Yet, changing dietary patterns among Chinese is not an easy task [39]. Having to change their diet in order to have better health, may instead have an adverse effect on their well-being.

A good knowledge of arthritis is needed for an explanation of the higher odds among Indians in reporting poor health, especially those who have this disease. Osteoarthritis and rheumatoid arthritis are among the common types of arthritis, though, the latter type is more painful and severe [40]. It has been found that prevalence in rheumatoid arthritis in India was higher than that in China and Indonesia [41]. Therefore, in our present study, a possible reason why Malaysian Indians were more affected by arthritis may be due to higher cases of rheumatoid arthritis, compared to the Chinese, Malays and Indigenous people.

There are pronounced gender differentials in the prevalence of NCDs. Our findings corroborate with reports that older females were more likely than older males to suffer from arthritis [42]. Older females, in general, were also more likely than older men to suffer from HBP [43], with the exception of the Chinese [44]. The higher odds of suffering from asthma among males may be due to higher tobacco use (Non-smokers: Females –86%, Males –32%). However, gender differentials in self-rated health are not consistent with findings from most studies. Our findings suggest older females were less likely than older males to report being in poor health run contrary to findings from several countries [19,20,45], including previous studies in Malaysia [11]. However, it is to be noted that the non-significant observed gender differential in self-rated health has become significant, after taking into account SES variables, which the earlier Malaysian study had not accounted for. Moreover, adjusting for chronic diseases may also alter gender differentials in self-rated health [46,47].

Our findings show a strong inverse relation between SES variables and poor self-rated health, and these are consistent with findings from other studies [17,18,19]. Higher educational attainment, having multiple sources of income and continued participation were found to lead to positive self-rated health among older persons. Our finding on the effects of work on health status reaffirms the "healthy worker effect" (HWE) [48]. Social connections developed through employment may have a positive psychological effect on health. But in our case, it is also likely that healthier older persons were more likely to continue working [49]. As seen in our analyses, Malaysians who were working were less likely to suffer from the 5 diseases. Nevertheless, the significance of SES variables does imply the importance of finances in accessing healthcare services and treatment for illnesses.

Interestingly, having multiple sources of income is positively predictive of HBP and CHD. It is probable that more sources of

income led to more affluent eating habits, and thus increased the risks of NCDs. A previous study on the prevalence of obesity in Malaysia which had included younger age groups found that Malays and Indians had higher prevalence of obesity, at around 13.5% each. The prevalence rate of obesity among Chinese and Indigenous groups in Sabah and Sarawak was relatively lower at 8.5%, 7.3% and 10.8% respectively. Gender differentials were also apparent as females were more likely to be obese at 13.8%, compared to males at 9.6% [50].

This study has several limitations. The analysis was confined to 5 NCDs as these were the only ones covered in the 2004 MPFS. A more comprehensive study of the health problems of older people would include the prevalence of obesity, other cardiovascular diseases, chronic respiratory diseases and cancer. Furthermore, self-reports of the 5 NCDs were not confirmed through medical personnel. Thus, the reliability of these self-reports may be questionable. However, studies conducted by the Malaysian Ministry of Health, which followed medical guidelines, reported almost similar statistics. For instance, according to the Third National Health and Morbidity survey in 2006, the prevalence of HBP and diabetes among the Malaysian adult population aged 30 and above, was 42.6% and 14.9% respectively [51]. Another study based on this survey had reported that 49.3% of older Malaysians aged 60 and above were aware of their HBP status, whereas 42.2% were receiving treatment for HBP [52]. Due to unavailable data, the number of sources of income was used to measure the relative financial position of the respondents, as the actual income was collected only for those who were currently working. The use of cross-sectional data precludes an analysis of the causal effects of lifestyle factors on the health status of older persons over a longer period. Given the dynamic changes in socio-economic conditions in the country during the last one decade [53], the 2004 MPFS is rather outdated. Nevertheless, this data set allows for an examination of health problems of older Malaysians of different ethnic origin. An update and more vigorous analysis will be carried out in 2015 with the release of the 2014 Malaysian round of survey.

"Prevention is better than cure" or so the old adage goes. Health intervention programs need to be stepped up to promote healthy diet and lifestyle among Malaysians from all age groups to contain the debilitating effects of NCDs [1]. Appropriate customized educational intervention according to ethnic groups and gender to help people understand and cope with NCDs will be more effective in containing these diseases [54]. Promoting active and productive aging could also lead to an improvement in health among the older people, while allowing them to be self-reliant in health care cost should the need arises.

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Author Contributions

Conceived and designed the experiments: JT NPT. Performed the experiments: JT NPT. Analyzed the data: JT NPT STN. Contributed reagents/materials/analysis tools: JT NPT STN. Wrote the paper: JT NPT.

References

1. World Health Organization (2011) Global status report on noncommunicable diseases 2010. Geneva.
2. Centers for Disease Control and Prevention (2009) Chronic diseases: The power to prevent, the call to control. Atlanta, GA: Centers for Disease Control and Prevention.

3. Centers for Disease Control and Prevention (2012) Diabetes report card 2012. Atlanta, GA.
4. Yoon S, Burt V, Louis T, Carroll M (2012) Hypertension among adults in the United States, 2009–2010. NCHS data brief, no107. Hyattsville, MD.
5. Ramachandran A, Snehalatha C, Kapur A, Vijay V, Mohan V, et al. (2001) High prevalence of diabetes and impaired glucose tolerance in India: National Urban Diabetes Survey. *Diabetologia* 44: 1094–1101.
6. Jylha M (2009) What is self-rated health and why does it predict mortality? Towards a unified conceptual model. *Social Science & Medicine* 69: 307–316.
7. Wu ZH, Rudkin L (2000) Social contact, socioeconomic status, and the health status of older Malaysians. *The Gerontologist* 40: 228–234.
8. Su Y-p, Ferraro KF (1997) Social relations and health assessments among older people: Do the effects of integration and social contributions vary cross-culturally? *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 52B: S27–S36.
9. Simon JG, De Boer JB, Joung IMA, Bosma H, Mackenbach JP (2005) How is your health in general? A qualitative study on self-assessed health. *Eur J Public Health* 15: 200–208.
10. World Health Organization (1958) The first ten years of the World Health Organization. Geneva: WHO.
11. Tengku Aizan H, Momtaz YA, Sharifah Norazizan SAR (2010) Older women and lower self-rated health. *Educational Gerontology* 36: 521–528.
12. Cheng S-T, Chan ACM (2006) Social support and self-rated health revisited: Is there a gender difference in later life? *Social Science & Medicine* 63: 118–122.
13. Liu X, Liang J, Gu S (1995) Flows of social support and health status among older persons in China. *Social Science & Medicine* 41: 1175–1184.
14. Mäntyselkä PT, Turunen JO, Ahonen RS, Kumpusalo EA (2003) Chronic pain and poor self-rated health. *JAMA* 290: 2435–2442.
15. Nishi A, Kawachi I, Shirai K, Hirai H, Jeong S, et al. (2012) Sex/gender and socioeconomic differences in the predictive ability of self-rated health for mortality. *PLoS ONE* 7: e30179.
16. Fillenbaum GG, Blay SL, Pieper CF, King KE, Andreoli SB, et al. (2013) The association of health and income in the elderly: Experience from a southern state of Brazil. *PLoS ONE* 8: e73930.
17. Svedberg P, Bardage C, Sandin S, Pedersen NL (2006) A prospective study of health, lifestyle and psychosocial predictors of self-rated health. *European Journal of Epidemiology* 21: 767–776.
18. Kaleta D, Polanska K, Dzikowska-Zaborszczyk E, Hanke W, Drygas W (2009) Factors influencing self-perception of health status. *Central European Journal of Public Health* 17: 122–127.
19. Giatti L, Barreto SM, César CC (2008) Household context and self-rated health: The effect of unemployment and informal work. *Journal of Epidemiology and Community Health* (1979–) 62: 1079–1085.
20. Asfar T, Ahmad B, Rastam S, Mulloli T, Ward K, et al. (2007) Self-rated health and its determinants among adults in Syria: A model from the Middle East. *BMC Public Health* 7: 1–9.
21. Ng N, Hakimi M, Santosa A, Byass P, Wilopo SA, et al. (2012) Is self-rated health an independent index for mortality among older people in Indonesia? *PLoS ONE* 7: e35308.
22. Idler EL, Benyamini Y (1997) Self-rated health and mortality: A review of twenty-seven community studies. *Journal of Health and Social Behavior* 38: 21–37.
23. Benyamini Y, Blumstein T, Lusky A, Modan B (2003) Gender differences in the self-rated health-mortality association: Is it poor self-rated health that predicts mortality or excellent self-rated health that predicts survival? *Gerontologist* 43: 396–405.
24. Frankenberg E, Jones NR (2004) Self-rated health and mortality: Does the relationship extend to a low income setting? *Journal of Health and Social Behavior* 45: 441–452.
25. Department of Statistics Malaysia (2010) Population distribution and basic demographic characteristics, 2010. Putrajaya.
26. DaVanzo J, Chan A (1994) Living arrangements of older Malaysians: Who coresides with their adult children? *Demography* 31: 95–113.
27. Department of Statistics Malaysia (2005) General report of 2000 population and housing census of Malaysia. Putrajaya.
28. Malaysian National Population and Family Development Board (2004) Malaysian Population and Family Survey: Peninsular Malaysia. Kuala Lumpur.
29. Malaysian National Population and Family Development Board (2004) Malaysian Population and Family Survey: Sabah. Kuala Lumpur.
30. Malaysian National Population and Family Development Board (2004) Malaysian Population and Family Survey: Sarawak. Kuala Lumpur: NPFDDB.
31. Hosmer DW, Lemeshow S (2000) Applied logistic regression. New York: John Wiley & Sons.
32. Department of Statistics Malaysia (2011) Abridged life tables, Malaysia 2008–2010. Putrajaya.
33. Centers for Disease Control and Prevention (2011) Arthritis-related statistics: Prevalence of Arthritis.
34. Yoon S, Ostchega Y, Louis T (2010) Recent trends in the prevalence of high blood pressure and its treatment and control, 1999–2008. NCHS data brief, no 48. Hyattsville, MD.
35. Ramachandran A, Snehalatha C, Latha E, Manoharan M, Vijay V (1999) Impacts of urbanisation on the lifestyle and on the prevalence of diabetes in native Asian Indian population. *Diabetes research and clinical practice* 44: 207–213.
36. International Diabetes Federation (2006) Diabetes atlas: Third edition. Brussels.
37. Lee H-Y, Choi CS, Birkenfeld AL, Alves TC, Jörnayvaz FR, et al. (2010) Targeted Expression of Catalase to Mitochondria Prevents Age-Associated Reductions in Mitochondrial Function and Insulin Resistance. *Cell Metabolism* 12: 668–674.
38. Woodward M, Zhang X, Barzi F, Pan W, Ueshima H, et al. (2003) The effects of diabetes on the risks of major cardiovascular diseases and death in the Asia-Pacific region. *Diabetes Care* 26: 360–366.
39. Zhang J, Xu A-q, Ma J-x, Shi X-m, Guo X-l, et al. (2013) Dietary sodium intake: Knowledge, attitudes and practices in Shandong province, China, 2011. *PLoS ONE* 8: e58973.
40. World Health Organization (2013) Chronic rheumatic conditions. Geneva: WHO.
41. Malaviya AN, Kapoor SK, Singh RR, Kumar A, Pande I (1993) Prevalence of rheumatoid arthritis in the adult Indian population. *Rheumatology International* 13: 131–134.
42. Arthritis Research UK (2012) Arthritis study reveals why gender bias is all in the genes.
43. National Institute of Health (2012) Who is at risk for high blood pressure?
44. Gao Y, Chen G, Tian H, Lin L, Lu J, et al. (2013) Prevalence of hypertension in China: A cross-sectional study. *PLoS ONE* 8: e65938.
45. Rueda S, Artazcoz L, Navarro V (2008) Health inequalities among the elderly in western Europe. *Journal of Epidemiology and Community Health* 62: 492–498.
46. Malmusi D, Artazcoz L, Benach J, Borrell C (2012) Perception or real illness? How chronic conditions contribute to gender inequalities in self-rated health. *The European Journal of Public Health* 22: 781–786.
47. Jylhä M, Guralnik JM, Ferrucci L, Jokela J, Heikkinen E (1998) Is self-rated health comparable across cultures and genders? *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 53B: S144–S152.
48. McMichael AJ (1976) Standardized mortality ratios and the 'Healthy Worker Effect': Scratching beneath the surface. *Journal of Occupational and Environmental Medicine* 18: 165–168.
49. Bartley M (1994) Unemployment and ill health: Understanding the relationship. *Journal of Epidemiology and Community Health* 48: 333–337.
50. Rampal L, Rampal S, Khor GL, Zain AM, Ooyub SB, et al. (2007) A national study on the prevalence of obesity among 16,127 Malaysians. *Asia Pac J Clin Nutr* 16: 561–566.
51. Malaysian Ministry of Health (2006) The Third National Health and Morbidity Survey (NHMS III) Report. Putrajaya.
52. Kiau BB, Kau J, Nainu BM, Omar MA, Saleh M, et al. (2013) Prevalence, awareness, treatment and control of Hypertension among the elderly: the 2006 National Health and Morbidity Survey III in Malaysia. *Med J Malaysia* 68: 332–337.
53. Department of Statistics Malaysia (2013) Report on education and social characteristics of the population 2010. Putrajaya: Department of Statistics Malaysia.
54. Baradaran HR, Knill-Jones RP, Wallia S, Rodgers A (2006) A controlled trial of the effectiveness of a diabetes education programme in a multi-ethnic community in Glasgow [ISRCT28317455]. *BMC Public Health* 6: 134.



The debilitating effects of chronic diseases among the oldest old in China



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ABSTRACT

Objectives: The aims of this study were to assess the current sharp rise in chronic diseases and disabilities with advancing age, and to examine the debilitating effects of chronic diseases among the oldest old in China.

Study design and outcome variables: This study used data from four waves of the Chinese Longitudinal Health and Longevity Survey (CLHLS) conducted in 2002, 2005, 2008 and 2011. The sample comprised 2137 older adults who were interviewed in 2002 and re-interviewed in the following waves. Cross-tabulations were run to show the rise in chronic disease and disability with age. Ordinal logistic regression was run to examine the debilitating effects of these diseases in terms of the ability of the oldest old to perform activities of daily living.

Results: The prevalence of chronic diseases rose sharply with age. The prevalence rate of six major diseases increased between 38% (respiratory diseases) and 533% (neurological disorder) among respondents who were re-interviewed nine years later. Cardiovascular diseases were the most common. Neurological disorder and cancer were less common, but had the most debilitating effects on patients. Overall, 10.0%, 3.1% and 3.1% of the respondents were disabled by cardiovascular, musculoskeletal and sensorial diseases, respectively. Ordinal logistic regression showed that neurological disorder had the strongest debilitating effects, followed by musculoskeletal and cardiovascular diseases among 2137 older persons who had survived and were followed up from the base year (2002) through 2011.

Conclusion: The rapid rise in chronic diseases has resulted in an increased burden of disability among the oldest old in China. There is a need to improve health care systems for the prevention and management of chronic diseases.

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1. Introduction

Population ageing has resulted in a rise of non-communicable diseases (NCDs) or chronic diseases and disability. In 2012, NCDs were responsible for 38 million (68%) of the world's 56 million deaths, and almost three quarters occurred in low and middle-income countries. Tobacco use, physical inactivity, unhealthy use of alcohol and unhealthy diets are the main risk factors of chronic diseases [1].

Cardiovascular diseases were the leading causes of deaths worldwide, accounting for 17.5 million deaths in 2012, followed by cancers (8.2 million), respiratory diseases (4 million) and diabetes (1.5 million). There were an estimated 46.8 million individuals liv-

ing with dementia in 2015, and this number is projected to double every 20 years to reach 74.7 million in 2030 and 131.5 million in 2050 [2]. Nearly half of the older adults who had dementia were disabled [3].

Cancer and cardiovascular diseases such as Ischaemic heart disease and stroke can be immediately life-threatening. By contrast, diabetes, hypertension, sensory impairments and mental diseases tend to persist over a long period and simultaneously cause disabilities among the patients [4]. Studies have shown that dementia and other neurological disorders such as epilepsy and Parkinson disease are the major causes of disability and dependence among older adults in both developing and developed countries [5–7]. Cardiovascular and musculoskeletal disorders such as stroke and arthritis are also significant contributors to disability among the older adults [3,6–8].

Self-reported disability, difficulties in performing basic activities of daily living (BADL), and instrumental activities of daily

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living (IADL) are among the common tools used to assess disability [7,9,10]. Past studies have shown that the prevalence of disability is often higher among older women than older men, and women often endure longer duration of disability than men [11,12].

With population ageing, the annual cardiovascular disease mortality and cancer death worldwide is projected to increase from 17.5 million and 8.2 million in 2012 to 22.2 million and 12.6 million in 2030 respectively, despite projected decrease in NCD death. In China, almost two thirds of NCD deaths were aged 70 and over. Hence, the Chinese Longitudinal Health and Longevity Survey (CLHLS) was carried out on the oldest old to provide data for deeper research and better policy for healthy ageing.

The contribution of chronic diseases to disability among older persons has been widely studied [3,5–8,13]. However, there is still a dearth of research on the impact of the rise of chronic diseases on disability among the very old adults (aged 80 and over), the fastest growing group in the developing countries, including China [9]. Unlike past studies which were mostly based on cross-sectional data [7,9,13], the present study, using the longitudinal data from CLHLS, provides a clear variable pattern of changes in specific chronic diseases and disability over time. Although a number of longitudinal studies on self-rated health and chronic diseases/mortality have been conducted in the developed countries [8,14,15], to our knowledge, no such study has been conducted in the developing countries using a large national data set.

China has the largest number of older adults in the world, and the older population is ageing rapidly [16]. The country has also undergone rapid epidemiological transition from infectious to chronic diseases, a process characterized by widespread under-diagnosis of chronic diseases and low rates of treatment and control [17]. Urbanization and modernization have resulted in behavioural changes such as tobacco and liquor consumption, sedentary life style and changing diets (with increased consumption of meat, fat and salt), all of which have increased the risk for chronic diseases [18].

The aims of the present study were:

- i) To determine the concurrent rise in chronic diseases and disabilities among the older men and women in China as they grew older; and
- ii) To examine the disability impacts of chronic diseases among the oldest old in China.

2. Methods

2.1. Data sources

Data for this study came from the 2002–2012 Chinese Longitudinal Healthy Longevity Surveys (CLHLS), consisting of 4 waves collected in 2002, 2005, 2008 and 2011. The CLHLS is a national survey of the older adults in China, across 22 provinces in the country. CLHLS questionnaire design was based on international standards and was adapted to the Chinese cultural and social context and carefully pretested. Questions that could not be reliably answered by the oldest old were excluded from the questionnaire.

A total of 9590 older adults aged 61–120 from all the 22 provinces in China were first interviewed in the 2002 baseline survey. In 2005, a total of 5460 (57%) were re-interviewed, 2863 (30%) had died and 1267 (13%) were lost to follow-up; in 2008, 3205 (59%) were re-interviewed, 1314 (24%) had died and 941 (17%) were lost to follow-up; and in 2011, 2137 (67%) were re-interviewed, 710 (22%) had died and 358 (11%) were lost to follow-up. The present analysis is based on the panel data of 2137 older persons that had survived and were followed up, from the base year (2002) through the subsequent waves in 2005, 2008 and 2011.

This CLHLS collected data on basic and instrumental activities of daily living, and 22 chronic conditions suffered by respondents. Information for the very old and frail respondents was obtained from family members who acted as proxies. Detailed description of the methodology including sampling design and evaluation of data quality of CLHLS has been reported by a number of researchers [19–22]. The CLHLS was conducted using the guidelines laid down in the Declaration of Helsinki, and all procedures involving human subjects/patients were approved by Biomedical Ethics Committee of Peking University (IRB00001052-13074). All participants signed a consent form. Permission to use data for this paper was given by the Duke University. Since we used secondary data with no identifiable information, no formal approval from an institutional review board was required for this study.

2.2. Measures

2.2.1. Severe disability (disabilities in basic activities of daily living – BADL)

The BADL measure consists of six items: bathing, dressing, toileting, indoor transferring, continence and self-feeding. Respondents were asked to state the degree of difficulty in performing these tasks on a scale of 1 (without assistance) to 3 (great difficulty). An index of severe disability was obtained by summing the score for the six items.

2.2.2. Moderate disability (disabilities in instrumental activities of daily living – IADL)

The IADL measure consists of eight items on a scale of 1–3, with higher scores indicating greater disability. IADL items include visiting neighbours, shopping, preparing meals, doing laundry, walking one kilometre, carrying 5 kg weight, crouching and standing three times, and taking public transportation. An index of moderate disability was obtained by summing the score of the eight items.

2.2.3. Chronic non-communicable diseases/disorders

The survey elicited information on 23 chronic non-communicable diseases/disorders, and 12 of the more common NCDs in our analyses include hypertension, diabetes, heart disease, stroke, chronic respiratory (bronchitis, emphysema, asthma, pneumonia), cataract, glaucoma, cancer, Parkinson, arthritis, dementia and epilepsy. Chronic diseases such as hepatitis, uterine tumour, galactophore disease, and chronic nephritis affected less than 1% of the respondents, and hence were not included in the analysis. The 12 selected chronic diseases were classified into 7 groups of disorders: cardiovascular (hypertension, heart disease and stroke), neurological (dementia, Parkinson and epilepsy), endocrine (diabetes), respiratory, cancer, musculoskeletal (arthritis) and sensorial (cataract and glaucoma).

2.2.4. Background

Socio-demographic variables in the multivariate analysis include respondent's age in 2011 (1–70s, 2–80s, 3–90+), gender (0–male, 1–female), ethnicity (0–minorities, 1–Han Chinese), place of residence (0–rural, 1–urban, combining those living in cities and town, and is defined as an area with an average population density of 1500/sq.km; and its contiguous suburbs where the local government is located) [23], marital status (0–unmarried: separated, divorced, widowed, never married, 1–married and living with spouse), years of schooling (0–1+ years schooling, 1–no schooling), primary occupation before age 60 (0–other sectors, comprising mainly those who previously worked in the manufacturing and services sectors, 1–agriculture: agriculture, forestry, fisheries, and animal husbandry), and self-perceived financial adequacy (0–inadequate, 1–adequate). The CLHLS did not collect individual income data as most of the respondents are dependent

on their children. Hence, self-perceived financial adequacy which has been used in many other studies [24–26] was used as an indicator of the financial status of the respondents.

2.3. Statistical analyses

In the bivariate analyses, the percentages who had suffered at least one of the diseases in each category, and those with disability were presented for the total sample, and for males and females separately for the four waves. The products of the prevalence rate of each disease and the percentage of those with the disease who were unable to perform BADL and IADL represent the percent of older adults aged 70 years and over who were disabled by each of these diseases/disorders.

Bivariate analysis was focussed on gender differentials as older men and women tend to be affected differently by different chronic diseases and have different level of disability, and this is reflected by the longer life expectancy among the females in most populations. While it is interesting and useful to examine socio-economic differentials in chronic diseases and disability, the small sample size of the sub-groups preclude such an analysis. For instance, the ethnic minorities made up only 7.5% of the population and the sample. The survey data showed that 52.3% of the respondents had never been to school and 47.7% had 1+ year of schooling, with no further breakdown of the educational categories. About two-thirds of the respondents were previously engaged in the agricultural sector, while manufacturing and services sector accounted for only about 10% each, and own account workers and home makers made up most of the rest. As for marital distribution, 59.4% were currently married, slightly more than a third were widowed, and less than 5% never married or divorced, and the last three groups were combined as “not married” in the analysis.

Multivariate analysis was performed using ordinal logistic regression to assess the net effect of the socio-demographic variables and the debilitating effects of NCDs, using the disability variable of the 4th wave (2011) as the dependent variable, with three categories – no disability, moderate disability and severe disability. The independent variables entered into the models included the 7 groups of chronic disorders of the 1st–4th wave, controlling for socio-demographic characteristics. In the ordinal logistic regression, the results were presented as proportional odds ratios (the coefficient exponentiated), and the 95% confidence interval.

As our multivariate models incorporated age, sex and place of residence, the sampling weight based on the distribution of age-sex-urban/rural residence, provided with the CLHLS data was not utilized [27]. The SPSS Generalized Linear Models version 20 was utilized to perform ordinal logistic regression analysis with a cumulative logit as the link function.

3. Results

Females made up slightly more than half of the sample. About two thirds of those interviewed in the first wave were aged 70 and over, with a mean age of 73, but in the fourth wave, all were aged 70 and over, with a mean age of 82. Majority were of the Hans ethnic group, and about two thirds were residing in the rural areas. The proportion that were currently married declined from 59% in 2002 to 42% among those who were re-interviewed nine years later. About half of the respondents had never been to school, and two thirds were engaged in agriculture previously. The percentage that perceived inadequate financial resources increased from 19% in 2002 to 24% in 2011 (Table 1).

Cardiovascular diseases were by far the most common diseases among the older adults in China (Table 2), and the prevalence rate increased sharply with age. In 2002, the prevalence rate for car-

Table 1
Basic characteristics (n = 2137).

Characteristics		2002	2005	2008	2011
		%			
Gender	Male	48.2	48.2	48.2	48.2
	Female	51.8	51.8	51.8	51.8
Age	60–64	1.1	0.0	0.0	0.0
	65–69	35.3	16.6	0.0	0.0
	70–74	30.2	32.3	29.8	7.0
	75–79	20.9	27.6	29.9	34.4
	80–84	7.2	16.5	23.9	29.1
	85–89	2.0	2.8	10.5	19.8
	90–94	2.0	2.0	2.3	5.0
	95–99	0.5	1.2	1.9	1.9
Ethnic	100+	0.8	1.0	1.6	2.8
	Minorities	7.5	7.5	7.5	7.5
Residence	Han	92.5	92.5	92.5	92.5
	Urban	35.0	35.9	38.0	54.2
Marital status	Rural	65.0	64.1	62.0	45.8
	Unmarried	40.6	46.7	52.6	58.0
Schooling (years)	Married	59.4	53.3	47.4	42.0
	1+ years	47.7	47.7	47.7	47.7
Primary occupation	0 years	52.3	52.3	52.3	52.3
	Other sectors	33.4	33.4	33.4	33.4
Finances	Agriculture	66.6	66.6	66.6	66.6
	Not adequate	19.4	25.1	22.7	24.3
	Adequate	80.6	74.9	77.3	75.7

diovascular diseases was 21.4% among the sample population, but this rose to 27.5%, 32.2% and 43.9% respectively for those who were re-interviewed about three years, six years and nine years later. Of the cardiovascular disorders, hypertension has the highest prevalence rate, followed by heart disease and stroke. Musculoskeletal disorder, ranked second in terms of prevalence rate, was the only one that registered a decline between 2008 and 2011 among those who were re-interviewed, following an increase from 19.5% in 2002 to 24.0% in 2008. This anomaly could be due to mortality or loss to follow up among those with the disease. Respiratory diseases were the third most common diseases, and the prevalence rate increased slightly from 10.0% in 2002 to 13.8% among those who were re-interviewed nine years later. Sensorial disorder also increased rapidly with age, from 7.3% among older adults in 2002 to 9.2%, 9.9% and 13.2% respectively when they were re-interviewed about 3 years, 6 years and 9 years later. Cataract was found to be more common than glaucoma. The prevalence rate for cancer, neurological disorder and endocrine was much lower, but increased very rapidly with age, from 0.3%, 0.6% and 1.5% in 2002 to 1.4%, 3.8% and 5.1% respectively among those who were re-interviewed nine years later. Of the neurological disorders, dementia has the highest prevalence, followed by Parkinson and epilepsy. Older males were much more likely than older females to suffer from respiratory disorder, but the reverse was true for endocrine and sensorial disorders. While older men started off with lower prevalence of cancer in 2002, they were twice as likely as the women to suffer from this disease as they aged. Gender differential in the prevalence for cardiovascular diseases and neurological disorder were less pronounced, as compared to other diseases (Table 2).

Studies have shown that older people tend to suffer from multiple diseases or disorders, as well as cognitive and other impairments [3,13,14]. Table 2 shows that between 48% and 86% of the older adults who had one chronic disease also had other disease(s). The percentage of older people who had more than one disease increased with age. People who have a disease tend to be weakened and are more susceptible to other diseases. Among respondents with cancer in 2002, only 16.7% had other disorders, but this increased sharply beyond 77.8% when they grew older.

Inability to carry out basic and instrumental activities for daily living increased rapidly with age. Table 3 shows that for BADL, the

Table 2
Percent of oldest old people in China with chronic diseases/disorders by gender.

Disorders	Both sexes				Male				Female			
	2002	2005	2008	2011	2002	2005	2008	2011	2002	2005	2008	2011
Cardiovascular	21.4 (38.7)	27.5 (46.1)	32.2 (45.7)	43.9 (47.7)	19.3 (35.7)	26.6 (43.1)	29.8 (43.0)	42.3 (47.2)	23.3 (41.1)	28.4 (48.7)	34.5 (47.9)	45.4 (48.0)
Neurological	0.6 (75.0)	0.8 (50.0)	1.1 (69.6)	3.8 (70.4)	0.7 (71.4)	0.8 (75.0)	1.3 (69.2)	3.6 (75.7)	0.5 (80.0)	0.9 (30.0)	0.9 (70.0)	4.0 (65.9)
Endocrine	1.5 (54.8)	2.2 (85.1)	2.9 (83.9)	5.1 (86.2)	1.2 (41.7)	1.7 (72.2)	2.6 (77.8)	4.1 (90.5)	1.7 (63.2)	2.6 (93.1)	3.2 (88.6)	6.1 (83.6)
Respiratory	10.0 (50.2)	11.6 (58.1)	10.8 (58.0)	13.8 (66.4)	12.7 (45.8)	14.6 (55.0)	12.8 (56.8)	16.1 (66.9)	7.4 (57.3)	8.8 (62.9)	9.0 (59.6)	11.7 (65.9)
Cancer	0.3 (16.7)	0.4 (77.8)	0.3 (83.3)	1.4 (75.9)	0.2 (–)	0.6 (83.3)	0.4 (100.0)	1.8 (78.9)	0.4 (25.0)	0.3 (66.7)	0.2 (50.0)	0.9 (70.0)
Musculoskeletal	19.5 (42.9)	21.8 (53.5)	24.0 (53.6)	16.1 (68.7)	16 (44.2)	19.9 (55.1)	21.3 (53.6)	14.4 (64.9)	22.8 (42.1)	23.5 (52.3)	26.5 (53.6)	17.8 (71.6)
Sensorial	7.3 (58.3)	9.2 (63.3)	9.9 (67.0)	13.2 (74.8)	5.4 (44.6)	7.4 (63.2)	8.6 (68.5)	11.3 (78.6)	9.0 (66.0)	10.8 (63.3)	11.1 (65.9)	14.9 (72.1)

Note: Figures in brackets show percentage who had other disease(s) besides the one being studied.

Table 3
Percent needing assistance performing BADL and IADL.

	Both sexes				Male				Female			
	2002	2005	2008	2011	2002	2005	2008	2011	2002	2005	2008	2011
BADL												
Bathing	3.4	3.8	4.6	16.4	3.1	3.1	4.0	14.2	3.7	4.4	5.2	18.4
Dressing	0.7	1.0	2.0	8.8	0.3	1.2	1.8	9.1	1.0	0.9	2.2	8.5
Toileting	0.6	1.3	2.3	7.6	0.4	1.2	2.0	7.1	0.7	1.4	2.5	8.0
Indoor transferring	0.5	0.9	1.4	6.4	0.4	0.9	1.0	6.0	0.6	0.9	1.7	6.9
Continence	0.5	0.7	0.9	5.0	0.4	0.5	0.6	5.3	0.6	1.0	1.3	4.7
Self-feeding	0.7	0.6	1.6	4.9	0.5	0.6	1.4	4.8	0.9	0.6	1.8	4.9
IADL												
Visit neighbours	2.2	3.6	7.3	16.2	1.2	2.6	5.4	13.2	3.1	4.5	9.1	19.0
Shopping	6.3	8.7	14.4	25.3	2.6	5.1	8.8	18.9	9.7	12.0	19.6	31.3
Preparing meals	5.8	8.7	14.2	24.5	6.4	8.7	14.0	22.2	5.2	8.7	14.4	26.6
Do laundry	7.1	10.6	14.0	24.3	7.4	11.2	14.3	23.6	6.9	10.0	13.7	24.9
Walk one kilometre	11.3	18.6	25.0	37.0	6.7	12.9	18.2	29.3	15.6	24.0	31.4	44.3
Carry 5 kg weight	13.5	18.3	23.1	34.1	6.7	10.1	14.0	24.4	19.9	26.0	31.6	43.2
Crouch and stand 3 times	18.2	25.4	30.3	42.5	10.6	17.4	21.4	34.8	25.2	32.8	38.5	49.6
Take public transportation	17.3	24.2	30.0	41.5	8.2	13.4	20.1	31.6	25.8	34.4	39.2	50.7

proportion of older adults who had difficulty bathing increased sharply from 3.4% in 2002 to 16.4% nine years later. The proportion who had difficulty performing other BADL also increased rather appreciably between the last two rounds of the surveys, with the prevalence rate increasing from 1.6% to 4.9% for self-feeding and from 2.0% to 8.8% for dressing.

A much higher proportion of the older adults were in need of assistance in performing IADL, as compared to basic activities for daily living. Relatively more older people were unable to carry out crouching and standing 3 times, and also to take public transportation; while visiting neighbours were relatively easier for them. The ability of the older adults to perform IADL also deteriorated rapidly with age (Table 3).

Gender differentials in carrying out BADL were relatively insignificant, except for bathing – 18.4% of the females in the 2011 wave were in need of assistance, as compared to 14.2% of the males. However, a much higher proportion of older women were in need of assistance to carry out most IADL, as compared to older men.

In 2011, about 13.3% of the respondents had severe disability (not able or had difficulty to perform BADL), caused mainly by chronic diseases. The disabling impact of most of the chronic diseases increased rather modestly between 2002 and 2008, but rose sharply when the same cohort were 3 years older in 2011 (Table 4). The disabling impact of each of these chronic diseases increased by 2–5 fold as they aged further by three years. The prevalence rate for neurological diseases and cancer was relatively low at only 3.8% and 1.4% respectively as at 2011. However, these diseases had very

severe debilitating effects. In 2011, about half of those with cancer and neurological diseases were in need of help to carry out BADL, as compared to about a quarter to a third among those suffering from other diseases or disorders.

The proportion of the total population who were disabled by each of the chronic diseases was estimated by taking the product of prevalence rate and the percent who were disabled by the disease. Except for cardiovascular diseases, less than 2% of the oldest old were disabled by the chronic diseases up to 2008, but rose sharply between 2008 and 2011, to 2.3% for neurological diseases, and more than 3% for respiratory, musculoskeletal and sensorial diseases or disorders.

Cardiovascular diseases being the most common diseases resulted in the largest number of severely disabled older persons (10.0%) in 2011, followed by respiratory diseases (3.3%), musculoskeletal and sensorial disorders (3.1% each) and neurological diseases (2.3%). Few people were disabled by cancer, due to the very high mortality rate.

Ordinal logistic regression was run to assess the effects of socio-demographic variables and chronic diseases on severe and moderate disability. The dependent variable was created with three categories – no disability (60.8%), moderate disability (disability or difficulty in performing IADL, 25.9%), and severe disability (disability or difficulty in performing BADL, 13.3%). The thresholds indicated the intercepts where the latent variable was cut to make the three levels of disability observed in this study.

Table 4
Percent with specific diseases/disorders contributing to severe disability among the oldest old in China, 2002–2011.

Disorders	% with disorders	% of older patients disabled by the disease	% of older population disabled by the disease
2002			
Cardiovascular	21.4	9.2	2.0
Neurological	0.6	25.0	0.2
Endocrine	1.5	6.5	0.1
Respiratory	10.0	6.6	0.7
Cancer	0.3	16.7	0.1
Musculoskeletal	19.5	4.8	0.9
Sensorial	7.3	11.5	0.8
2005			
Cardiovascular	27.5	8.3	2.3
Neurological	0.8	27.8	0.2
Endocrine	2.2	14.9	0.3
Respiratory	11.6	3.6	0.4
Cancer	0.4	11.1	<0.1
Musculoskeletal	21.8	6.2	1.4
Sensorial	9.2	7.1	0.7
2008			
Cardiovascular	32.2	8.4	2.7
Neurological	1.1	30.4	0.3
Endocrine	2.9	9.7	0.3
Respiratory	10.8	4.8	0.5
Cancer	0.3	16.7	0.1
Musculoskeletal	24.0	4.3	1.0
Sensorial	9.9	14.2	1.4
2011			
Cardiovascular	43.9	22.7	10.0
Neurological	3.8	60.0	2.3
Endocrine	5.1	28.3	1.4
Respiratory	13.8	24.2	3.3
Cancer	1.4	39.3	0.6
Musculoskeletal	16.1	19.5	3.1
Sensorial	13.2	23.4	3.1

Of the socio-demographic in the ordinal logistic regression, age, marital status, educational level, and perceived financial adequacy were significant predictors, but gender, ethnicity, place of residence, and prior occupation were not. Those who were in the 80s and 90+ age groups were much more likely to have disability, as compared to those in the 70s age group (proportional odds ratios 2.58 and 8.12 respectively – Table 5). Those with no schooling were also more likely to have disability (1.54) than those who had been to school. However, the married respondents and those who perceived having adequate finance were less likely to have disability (0.80 and 0.63 respectively).

In the 1st wave (2002), sensorial disorders and cardiovascular diseases were the only two significant causes of disability (proportional odds ratios 1.80 and 1.43 respectively – Table 5), net of other variables and diseases. Beginning from the second wave (2005), neurological disorder had the greatest impact on disability (proportional odds ratios of 2.74 in 2005, 3.94 in 2008 and 5.16 in 2011), and it was the only disorder that had a significant impact on disability in the third wave (2008). In the second wave (2005), cardiovascular diseases was the only other significant health condition that contributed to disability. In the 4th wave in 2011, neurological diseases continued to have the greatest impact on disability (5.16), followed by musculoskeletal disorder (1.36) and cardiovascular diseases (1.31), net of the effects of other variables and diseases. Despite having a proportional odds ratio of 1.88, cancer was not a significant contributor to disability due to the large margin of error in the estimate (95% confidence interval: 0.83, 4.26). Changes in the debilitating effects of diseases/disorders, such as sensorial disorder, from being a significant to an insignificant predictor over the four

Table 5
Ordinal logistic regression on disability.

	Proportional Odds Ratios	p-value	95% CI
Threshold			
No disability	5.72**	0.000	(3.48, 9.41)
Moderate disability	32.52**	0.000	(19.39, 54.57)
Age (ref: 70s)			
80s	2.58**	0.000	(2.09, 3.20)
90+	8.12**	0.000	(5.79, 11.39)
Female	1.25	0.056	(0.99, 1.57)
Ethnic Han	1.04	0.842	(0.72, 1.49)
Urban	0.99	0.948	(0.82, 1.21)
Married	0.80*	0.040	(0.65, 0.99)
No schooling	1.54**	0.000	(1.23, 1.93)
Agriculture	1.15	0.240	(0.91, 1.45)
Finances adequate	0.63**	0.000	(0.50, 0.78)
Diseases (1st wave)			
Cardiovascular	1.43**	0.004	(1.12, 1.83)
Neurological	0.76	0.649	(0.24, 2.46)
Endocrine	0.73	0.487	(0.31, 1.76)
Respiratory	0.95	0.761	(0.68, 1.32)
Cancer	0.28	0.324	(0.02, 3.52)
Musculoskeletal	0.88	0.327	(0.69, 1.13)
Sensorial	1.80**	0.001	(1.26–2.57)
Diseases (2nd wave)			
Cardiovascular	1.33*	0.019	(1.05, 1.69)
Neurological	2.74*	0.033	(1.09, 6.90)
Endocrine	1.31	0.455	(0.64, 2.67)
Respiratory	1.28	0.126	(0.93, 1.76)
Cancer	0.42	0.369	(0.06, 2.80)
Musculoskeletal	0.98	0.881	(0.78, 1.24)
Sensorial	1.10	0.581	(0.79, 1.53)
Diseases (3rd wave)			
Cardiovascular	1.07	0.539	(0.86, 1.35)
Neurological	3.94**	0.003	(1.58, 9.83)
Endocrine	0.77	0.443	(0.39, 1.52)
Respiratory	1.12	0.517	(0.80, 1.55)
Cancer	1.19	0.848	(0.20, 6.98)
Musculoskeletal	0.91	0.399	(0.72, 1.14)
Sensorial	1.26	0.165	(0.91, 1.74)
Diseases (4th wave)			
Cardiovascular	1.31*	0.013	(1.06, 1.62)
Neurological	5.16**	0.000	(3.16, 8.42)
Endocrine	1.46	0.145	(0.88, 2.41)
Respiratory	1.26	0.105	(0.95, 1.68)
Cancer	1.88	0.130	(0.83, 4.26)
Musculoskeletal	1.36*	0.016	(1.06, 1.75)
Sensorial	0.98	0.889	(0.73, 1.31)

Pearson $\chi^2 = 3,708.40$, $df = 3617$, log likelihood = $-1,590.11$.

* $p < 0.05$.

** $p < 0.01$.

waves, may be attributed to sample attrition due to mortality and non-contact.

4. Discussion

The main variables in this study, the ability to perform activities of daily living and chronic diseases/disorders, are based on self-report. The reliability of such subjective measures has been questioned [28]. Few authors have also noted self-report measures as a limitation in their studies [9,14]. However, many researchers have found self-report an accurate prevalence estimates for chronic disease and disability [7,8,29–37]. Careful assessments by a number of researchers found that the reliability and validity of the IADL measures obtained from CLHLS are reasonably good [20,38,39].

Data from CLHLS provided strong evidence of a concurrent sharp rise in chronic diseases and disability with age among the oldest old in China. Older adults tended to develop multiple illnesses as they grew older. Findings from the present study corroborate with that of an earlier study by Wolff et al. [6] that found that after 36 months

of follow-up, as many as 61% of the participants had one or more newly diagnosed conditions, and these newly developed conditions were associated with greater probability of functional dependency. The high prevalence of chronic diseases and disability among the oldest old will strain the health care and social support system, in countries such as China where the proportion of population aged 80 and over to older population aged 65 and above will increase to 32.5% in 2050, from 16.1% in 2010 [40].

Consistent with findings from previous studies [8,13,14], older women have higher prevalence of chronic diseases and are more dependent on others to carry out BADL and IADL as compared to older men. A plausible explanation is that older men are more likely to die suddenly. In contrast, older women have longer life expectancy and are more likely to experience a longer period of physical degeneration [41–43], and without the care from the spouse. In China, older women aged 65 and over were at least twice as likely as older men to be widowed (46.7% versus 21.1%) [44]. Hence, older women with disability were less likely to have the spouse to take care of them owing to their higher rate of widowhood.

The increased dependence associated with chronic diseases have been well established in past studies [3,6–8]. This study found that cardiovascular diseases were the main contributor to the total burden of disability due to its high prevalence. Other less common diseases also contribute significantly to the burden of disability due to the high disabling impact. For instance, despite the rather low prevalence rate, dementia and stroke have the most debilitating effects among the older adults, and this corroborates the findings of Sousa et al. [3]. According to the World Alzheimer Report [2], there are now 46.8 million people with dementia worldwide, with numbers projected to almost double every 20 years. The report noted that dementia is typically associated with particularly intense needs for care, with huge quality of life impacts both for individuals living with dementia and for their families and carers.

The increase in the number of older adults with disability means that more care providers are needed. Long term care for patients with chronic diseases will impose high opportunity cost for working adults, and affect the overall wellbeing of the family. Although many older adults still depend on their children for support, such support is fast diminishing due to the very low fertility, partly as a result of the One-Child Policy implemented since the late 1970s. Mass rural-urban migration [45] and increased female labour force participation in the modern sector have further eroded the family care for older people with disability. Hence, there is a need for alternative care arrangement such institutional care, community support, and introduction of flexi hours for working adults to take care of their disabled parents. The escalating cost of medical and health care may prove prohibitive for most older adults and their families. Some forms of subsidies may be needed to assist the poor. On the more positive side, as a result of rapid economic growth in China, the government is likely to invest more on social development programs, including expanding the community health care centres for the benefits of the citizens [46].

Chronic diseases are particularly devastating in poor and vulnerable populations. The World Health Organization (WHO) has identified NCDs as one of the major health and development challenges of the 21st century. The WHO report (1) and a prior study conducted in China [18], cited above, have found that tobacco and liquor consumption, sedentary life style and changing diets (with increased consumption of meat, fat and salt) are the main contributory factors to the increased risk for chronic diseases. It is imperative for national governments and all stake holders to follow the recommended strategies of the WHO to reduce NCDs by having programs to reduce harmful use of alcohol, physical inactivity, salt/sodium intake, tobacco use and hypertension, halt the

rise in diabetes and obesity, and improve coverage of treatment, to prevent and manage chronic diseases.

There is a need for concerted efforts to promote healthy living from young, to prevent the future generation from NCDs when they grow old. Curative and rehabilitative programs should also be implemented to provide long term care to the patients and respite care to the care providers. Health sector should be accorded top priority in the national budget, to improve the availability and affordability of technologies and essential medicine for the management of chronic diseases.

5. Conclusion

The rapid rise in chronic diseases and their effects on disability in China and elsewhere is alarming. Increase in chronic diseases and disabilities poses a burden to the family, community, health care system and the nation. International agencies, in particular the WHO, the governments and the public must work hand in hand to combat the NCDs and the debilitating effects of these diseases, as well as to improve the health care system to maintain the quality of life of all citizens. Attention should be directed to the preventative, curative and rehabilitative aspects of health care. It is vital to promote healthy living as a preventive strategy, and to improve the management of chronic diseases. While measures should be implemented to promote healthy living as a preventive strategy, concerted efforts must also be made to improve the management of chronic diseases.

Contributors

NPT conceptualized the study, formulated the analytical strategies, wrote the first draft, and edited the final paper.

SLL carried out the analyses and prepared the article for the journal.

JKLT contributed to the literature review, constructed the variables and ran the initial tabulations.

All authors read and approved the final manuscript.

Conflict of interest

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Ethical approval

The CLHLS was conducted using the guidelines laid down in the Declaration of Helsinki, and all procedures involving human subjects/patients were approved by Biomedical Ethics Committee of Peking University (IRB00001052-13074). All participants signed a consent form. Permission to use data for this paper was given by the Duke University. Since we used secondary data with no identifiable information, no formal approval from an institutional review board was required for this study.

Provenance and peer review

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References

- [1] World Health Organization, Global Status Report on Noncommunicable Diseases, World Health Organization, Geneva, Switzerland, 20142014.

- [2] Alzheimer's Disease International, World Alzheimer report, in: *The Global Impact of Dementia: An Analysis of Prevalence, Incidence, Cost and Trends*, Alzheimer's Disease International, London, 2015, pp. 2015.
- [3] R.M. Sousa, C.P. Ferri, D. Acosta, E. Albanese, M. Guerra, Y. Huang, K.S. Jacob, A.T. Jotheeswaran, J.J. Rodriguez, G.R. Pichardo, M.C. Rodriguez, A. Salas, A.L. Sosa, J. Williams, T. Zuniga, M. Prince, Contribution of chronic diseases to disability in elderly people in countries with low and middle incomes: a 10/66 Dementia Research Group population-based survey, *Lancet* 374 (9704) (2009) 1821–1830.
- [4] World Health Organization, *The global burden of disease: 2004 update*, Geneva, 2008.
- [5] V.S. Thomas, Excess functional disability among demented subjects? Findings from the Canadian Study of Health and Aging, *Dement. Geriatr. Cogn. Disord.* 12 (3) (2001) 206–210.
- [6] J.L. Wolff, C. Boulton, C. Boyd, G. Anderson, Newly reported chronic conditions and onset of functional dependency, *J. Am. Geriatr. Soc.* 53 (5) (2005) 851–855.
- [7] C. Palazzo, J.-F. Ravaud, L. Trinquart, M. Dalichampt, P. Ravaud, S. Poiraudeau, Respective contribution of chronic conditions to disability in France: results from the national disability-health survey, *PLoS One* 7 (9) (2012) e44994.
- [8] B. Klijns, W.J. Nusselder, C.W. Looman, J.P. Mackenbach, Contribution of chronic disease to the burden of disability, *PLoS One* 6 (9) (2011) e25325.
- [9] H. Wang, K. Chen, Y. Pan, F. Jing, H. Liu, Associations and impact factors between living arrangements and functional disability among older Chinese adults, *PLoS One* 8 (1) (2013) e53879.
- [10] D. Gu, Q. Xu, Sociodemographic effects on the dynamics of task-specific ADL functioning at the oldest-old ages: the case of China, *J. Cross Cult. Gerontol.* 22 (1) (2007) 61–81.
- [11] S.G. Leveille, B.W. Penninx, D. Melzer, G. Izmirlian, J.M. Guralnik, Sex differences in the prevalence of mobility disability in old age: the dynamics of incidence, recovery, and mortality, *J. Gerontol. Series B: Psychol. Sci. Soc. Sci.* 55 (1) (2000) S41–S50.
- [12] D. Oman, D. Reed, A. Ferrara, Do elderly women have more physical disability than men do? *Am. J. Epidemiol.* 150 (8) (1999) 834–842.
- [13] R.M. Sousa, C.P. Ferri, D. Acosta, M. Guerra, Y. Huang, K. Jacob, A. Jotheeswaran, M.A. Hernandez, Z. Liu, G.R. Pichardo, J.J. Rodriguez, A. Salas, A.L. Sosa, J. Williams, T. Zuniga, M. Prince, The contribution of chronic diseases to the prevalence of dependence among older people in Latin America, China and India: a 10/66 Dementia Research Group population-based survey, *BMC Geriatr.* 10 (53) (2010) 1471–2318.
- [14] W.W. Hung, J.S. Ross, K.S. Boockvar, A.L. Siu, Recent trends in chronic disease, impairment and disability among older adults in the United States, *BMC Geriatr.* 11 (47) (2011).
- [15] A. Nishi, I. Kawachi, K. Shirai, H. Hirai, S. Jeong, K. Kondo, Sex/gender and socioeconomic differences in the predictive ability of self-rated health for mortality, *PLoS One* 7 (1) (2012) e30179.
- [16] United Nations, *World Population Prospects: The 2012 Revision*, United Nations New York, 2014.
- [17] X. Lei, N. Yin, Y. Zhao, Socioeconomic status and chronic diseases: the case of hypertension in China, *China Econ. Rev.* 23 (1) (2012) 105–112.
- [18] G. Yang, L. Kong, W. Zhao, X. Wan, Y. Zhai, L.C. Chen, J.P. Koplan, Emergence of chronic non-communicable diseases in China, *Lancet* 372 (9650) (2008) 1697–1705.
- [19] Y. Zeng, J.W. Vaupel, Z. Xiao, C. Zhang, Y. Liu, Sociodemographic and health profiles of the oldest old in China, *Popul. Dev. Rev.* 28 (2) (2002) 251–273.
- [20] Y. Zeng, Towards deeper research and better policy for healthy aging – Using the unique data of Chinese Longitudinal Healthy Longevity Survey, *China Econ. J.* 5 (2–3) (2012) 131–149.
- [21] Y. Zeng, D. Gu, Reliability of age reporting among the Chinese oldest-old in the CLHLS datasets, in: Y. Zeng, D.L. Poston, D.A. Vloski, D. Gu (Eds.), *Healthy Longevity in China: Demographic, Socioeconomic, and Psychological Dimensions*, Springer, Dordrecht, 2008, pp. e61–e79.
- [22] L. Qiu, J. Sautter, Y. Liu, D. Gu, Age and gender differentials in association between sleep and mortality among very old Chinese, *Sleep Med.* 12 (2011) 10081017.
- [23] K.W. Chan, Y. Hu, Urbanization in China in the 1990: new definition, different series, and revised trends, *China Rev.* 3 (2) (2003) 49–71.
- [24] H. Litwin, E.V. Sapi, Perceived income adequacy among older adults in 12 countries: findings from the survey of health, ageing, and retirement in Europe, *Gerontologist* 49 (3) (2009) 397–406.
- [25] J.J. Xiao, C. Chen, F. Chen, Consumer financial capability and financial satisfaction, *Soc. Indic. Res.* 118 (1) (2014) 415–432.
- [26] Y.H. Cheng, I. Chi, K.W. Boey, L.S.F. Ko, K.L. Chou, Self-rated economic condition and the health of elderly persons in Hong Kong, *Soc. Sci. Med.* 55 (8) (2002) 1415–1424.
- [27] C. Winship, L. Radbill, Sampling weights and regression analysis, *Sociol. Methods Res.* 23 (2) (1994) 230–257.
- [28] A. Zajacova, J.B. Dowd, Reliability of self-rated health in US adults, *Am. J. Epidemiol.* 174 (8) (2011) 977–983.
- [29] D.M. Tisnado, J.L. Adams, H. Liu, C.L. Damberg, W.P. Chen, F.A. Hu, D.M. Carlisle, C.M. Mangione, K.L. Kahn, What is the Concordance between the medical record and patient self-report as data sources for ambulatory care? *Med. Care* 44 (2) (2006) 132–140.
- [30] J.T. Elam, M.J. Graney, T. Beaver, D. el Derwi, W.B. Applegate, S.T. Miller, Comparison of subjective ratings of function with observed functional ability of frail older persons, *Am. J. Public Health* 81 (9) (1991) 1127–1130.
- [31] H. Benitez-Silva, M. Buchinsky, H.M. Chan, S. Cheidvasser, J. Rust, How large is the bias in self-reported disability? *J. Appl. Econometrics* 19 (6) (2004) 649–670.
- [32] S. Merrill, T. Seeman, S. Kasl, L. Berkman, Gender differences in comparison of self reported disability and performance measure, *J. Gerontol.: Med. Sci.* 52A (1) (1997) M19–M26.
- [33] R.G. Brown, B. MacCarthy, M. Jahanshahi, C.D. Marsden, Accuracy of self-reported disability in patients with parkinsonism, *Arch. Neurol.* 46 (9) (1989) 955–959.
- [34] D.M.W. Kriegsman, B.W.J.H. Penninx, J.T.M. Van Eijk, A.J.P. Boeke, D.J.H. Deeg, Self-reports and general practitioner information on the presence of chronic diseases in community dwelling elderly. A study on the accuracy of patients' self-reports and on determinants of inaccuracy, *J. Clin. Epidemiol.* 49 (12) (1996) 1407–1417.
- [35] H. Baumeister, L. Kriston, J. Bengel, M. Härter, High agreement of self-report and physician-diagnosed somatic conditions yields limited bias in examining mental-physical comorbidity, *J. Clin. Epidemiol.* 63 (5) (2010) 558–565.
- [36] Y. Lee, S. Shinkai, A comparison of correlates of self-rated health and functional disability of older persons in the Far East: Japan and Korea, *Arch. Gerontol. Geriatr.* 37 (1) (2003) 63–76.
- [37] N.O. Månsson, L. Rastam, Self-rated health as a predictor of disability pension and death—A prospective study of middle-aged men, *Scand. J. Public Health* 29 (2) (2001) 151–158.
- [38] D. Gu, General data quality assessment of the CLHLS, in: Y. Zeng, P. Dudley, V.D. Ashbaugh, D. Gu (Eds.), *Healthy Longevity in China: Demographic, Socioeconomic, and Psychological Dimensions*, Springer Publisher, Dordrecht, 2008, pp. 39–60.
- [39] H. Chen, Assessment of the quality of the cross-sectional data collected in the 2008–2009 wave of Chinese Longitudinal Healthy Longevity Survey, in: Y. Zeng (Ed.), *Research on Elderly Population, Family, Health and Care Needs/Costs*, Science Press, Beijing, 2010, pp. 350–352.
- [40] United Nations, Department of Economic and Social Affairs, *Population Division, World Population Prospects: The 2015 Revision*, 2015.
- [41] D.P. Zipes, H.J.J. Wellens, Sudden cardiac death, *Circulation* 98 (1998) 2334–2351.
- [42] M.T. Puts, P. Lips, D.J. Deeg, Sex differences in the risk of frailty for mortality independent of disability and chronic diseases, *J. Am. Geriatr. Soc.* 53 (2005) 40–47.
- [43] D. Gu, M.E. Dupre, D.F. Warner, Y. Zeng, Changing health status and health expectancies among older adults in China: gender differences from 1992 to 2002, *Soc. Sci. Med.* 68 (12) (2009) 2170–2179.
- [44] United Nations, Department of Economic and Social Affairs, *Population Division, World Marriage Data 2012*, New York, USA, 2013.
- [45] K.W. Chan, China, internal migration, in: I. Ness, P. Bellwood (Eds.), *The Encyclopedia of Global Migration*, Blackwell Publishing, 2011, pp. 1–46.
- [46] L.-J. Liu, Y. Li, K. Sha, Y. Wang, X. He, Patient assessment of chronic illness care, glycemic control and the utilization of community health care among the patients with type 2 diabetes in Shanghai, China, *PLoS One* 8 (9) (2013), e73010–e73010.

CHAPTER 4: CONCLUSION

4.1 Introduction

The world health landscape is changing rapidly as a result of demographic and epidemiological transitions. The declining trends in mortality and fertility have resulted in population ageing with corresponding rise in chronic diseases or non-communicable diseases (NCDs) with high prevalence among the older population. NCDs is now the major cause of mortality. Globally, maternal mortality has declined significantly but it remains at a high level in some developing countries, mostly in sub-Saharan Africa and South Asia. The target of reducing maternal mortality ratio (MMR) by three quarters and achieving universal access to reproductive health service between 1990 and 2015 is one of the most off-track of all Millennium Development Goals (MDGs) target. Improving maternal health is part of the unfinished agenda for the post-2015 development agenda under Sustainable Development Goals (SDGs).

This thesis comprises five essays on proximate determinants of fertility, abortion, utilization of health services for delivery and NCDs (with two essays). The main findings from the five articles, as written in the published articles are recapitulated below.

4.2 Summary of Findings from Published Essays

4.2.1 Proximate Determinants of Fertility in Peninsular Malaysia

The continuing decline in fertility despite a contraction in contraceptive use in Peninsular Malaysia since the mid-1980s has triggered considerable interest in the reasons behind this phenomenon, such as increase in abortion, sterility, and out-of-wedlock pregnancy. Fertility decline has been attributed to rapid socio-economic development, which can only influence fertility through the intermediate variables. Application of vital statistics, population census, and survey data of Peninsular Malaysia on Bongaarts' model vindicates that marriage postponement and contraceptive use are the two most important proximate determinants of fertility, but the effects are not uniform across the ethnic groups. For instance, the predicted total fertility rate (TFR) for Chinese and Malays are 2.9 and 1.6, respectively, compared with the observed level of 3.0 and 1.9. Postpartum infecundability and abortion also play a part in explaining ethnic fertility differentials. The fertility inhibiting effects of these proximate determinants have significant implications on reproductive health and future population growth.

4.2.2 Medical Students' Attitudes toward Abortion Education: Malaysian Perspectives

Abortion is a serious public health issue, and it poses high risks to the health and life of women. Yet safe abortion services are not readily available because few doctors are trained to provide such services. Many doctors are unaware of laws pertaining to abortion.

A 2011 survey on medical students in two public universities and a private university in Malaysia shows that 9 out of 10 students wanted more training on the general knowledge and legal aspects of abortion, and pre- and post-abortion counseling. About 76 percent to 81 percent were in favor of including surgical abortion techniques and medical abortion in the curriculum, while the majority of the rest were neutral. Desire for more abortion education was associated with students' pro-choice index, their intention to provide abortion services in future practice, and year of study. However, students' attitudes toward abortion were not significantly associated with gender, type of university, or ethnicity. Some students intend to provide abortion counseling and services in their future practice. Medical schools should include abortion education in the new curriculum because majority of the students are in favor. Abortion education is an important step towards making available safe abortion services to enable women to exercise their reproductive rights.

4.2.3 Correlates of and Barriers to the Utilization of Health Services for Delivery in South Asia and sub-Saharan Africa

The high maternal and neonatal mortality rates in South Asia and sub-Saharan Africa can be attributed to the lack of access and utilization of health services for delivery. Data from the Demographic and Health Surveys (DHS) conducted in Bangladesh, India, Pakistan, Kenya, Nigeria, and Tanzania show that more than half of the births in these countries were delivered outside a health facility. Institutional delivery was closely associated with educational level, family wealth, place of residence, and women's media exposure status, but it was not influenced by women's work status and their roles in decision-making (with the exception of Nigeria). Controlling for other variables, higher parity and younger women were less likely to use a health facility for delivery. Within

each country, the poorer, less educated and rural women had higher unmet need for maternal care services. Service related factors (accessibility in terms of cost and distance) and socio-cultural factors (e.g. did not perceive the need for the services and objections from husband and family) also posed as barriers to institutional delivery. The paper concludes with some suggestions to increase institutional delivery.

4.2.4 Ethnic and Gender Differentials in Non-communicable Diseases and Self-rated Health in Malaysia

Data for this paper are obtained from the 2004 Malaysian Population and Family Survey. The survey covered a nationally representative sample of 3,406 persons aged 50 and over, comprising three main ethnic groups (Malays, Chinese and Indians) and all other indigenous groups. Bivariate analyses and hierarchical logistic regression were used in the analyses.

Arthritis was the most common NCD, followed by high blood pressure (HBP), diabetes, asthma and coronary heart disease (CHD). Older females were more likely than males to have arthritis and HBP, but males were more likely to have asthma. Diabetes and CHD were most prevalent among Indians, while arthritis and HBP were most prevalent among the Indigenous groups. Older people were more likely to report poor health if they suffered from NCD, especially CHD. Controlling for socio-economic, health and lifestyle factors, Chinese were least likely to report poor health, whereas Indians and Indigenous people were more likely to do so. Chinese that had HBP were more likely to report poor health compared to other ethnic groups with the same disease. Among those with arthritis, Indians were more likely to report poor health.

Perceived health status and prevalence of arthritis, HBP, diabetes, asthma and CHD varied widely across ethnic groups. Promotion of healthy lifestyle, early detection and timely intervention of NCDs affecting different ethnic groups and gender with socio-cultural orientations would go a long way in alleviating the debilitating effects of the common NCDs among older people.

4.2.5 The Debilitating Effects of Chronic Diseases among the Oldest Old in China

Among the older adults in China, cardiovascular diseases were the most common diseases, followed by musculoskeletal disorder and respiratory diseases. Of the cardiovascular disorders, hypertension has the highest prevalence rate, followed by heart disease and stroke. The prevalence rate for cancer, neurological disorder and endocrine was much lower, but increased very rapidly with age. Of the neurological disorders, dementia was most prevalent, followed by Parkinson and epilepsy. Older people tend to suffer from multiple diseases or disorders. Among those with cardiovascular diseases, about half had other diseases, and for those with endocrine, close to 90 percent had other diseases.

Inability to carry out basic activities of daily living (BADL) and instrumental activities of daily living (IADL) increased rapidly with age. For instance, the proportion of older adults who had difficulty bathing increased sharply from 3.4 percent in 2002 to 16.4 percent when they were nine years older (in 2011). Cardiovascular diseases resulted in the largest number of severely disabled older persons (10.0 percent), followed by respiratory diseases (3.3 percent), musculoskeletal and sensorial disorders (3.1 percent each) and neurological diseases (2.3 percent).

In 2011, about 13.3 percent of the respondents had severe disability (not able or had difficulty to perform BADL), caused mainly by chronic diseases. The disabling impact of each of these chronic diseases increased by 2-5 fold as they aged further by three years. The prevalence rate for neurological diseases and cancer was relatively low at only 3.8 percent and 1.4 percent respectively as at 2011. However, these diseases had very severe debilitating effects. In 2011, about half of those with cancer and neurological diseases were in need of help to carry out BADL, as compared to about a quarter to a third among those suffering from other diseases or disorders. Ordinal logistic regression shows that neurological diseases have the greatest impact on disability, followed by musculoskeletal disorder, and cardiovascular diseases, net of the effects of other variables and diseases.

4.3 Recommendations

4.3.1 Recommendations for Policies and Programs

The under-developed health infrastructure contributes to the poor health conditions in low-resource countries. Unavailability of health services and user cost are the two main supply-side barriers to their utilization resulting in high morbidity and mortality. Achieving universal access to health remains the global goal, and to achieve that each country must invest more to upgrade the facilities, train and recruit more health personnel, and to provide some forms of subsidies to the poor.

A comprehensive *National Health Policy* is needed to provide the framework for the delivery of health services to meet the changing needs of all. Individual country may adopt or adapt World Health Organization (WHO) guidelines, including the Global NCDs Action Plan and the global targets. The programs and measures should aim at addressing

the root causes of reproductive and public health problems such as maternal morbidity and mortality, unsafe abortion, HIV, infertility, unmet need for contraception, unwanted pregnancies, mental disorder, gender-based violence, as well as NCDs. Given the huge inequalities in health and health care, programs should be targeted at groups that are at risks, especially the poor, the less educated, the marginalized, and those living in remote areas. Barriers and modifiable risk factors should be identified and remedial actions taken. Measures should be taken to overcome shortage of specialists such as geriatricians, cardiologists, oncologists, psychologists and counsellors. Medical schools should incorporate abortion training in order to reduce the number of unsafe abortions. The *National Health Policy* may include legislation to discourage tobacco and alcohol consumption so as to reduce NCD risks. Lack of knowledge of the services and high cost of health care are two of the main barriers to the use of health facilities. Hence, efforts should be made to enhance health education, and to disseminate information on the services. Such information campaigns may include promotion of healthy life style and healthy dietary habits, as well as physical activities. The government should continue to provide subsidies to the poor to ensure more equitable access to health services. The alternative providers including the traditional healers and traditional birth attendants (TBAs) may be preferred and they have an important role in health care, especially among the poor. Hence, it is imperative to incorporate traditional practitioners in the national health care system.

Supply-side barriers contribute to the under-utilization or non-use of health services. Hence, the health sector should be given priority in the annual budget allocation to enable public health facilities to continue providing free or subsidized health care services to those who are unable to afford the escalating cost of such services, including medicines. There is also a need to control the rising cost of health care services by the private sector.

The public should also be encouraged to take up health care insurance, with support from employers, who should in turn be given some incentives in terms of tax rebate. Mobile health units can be mobilized to bring health services closer to the users.

Achieving universal education is also one of the MDGs target. In almost all the studies, education has been found to be the main determinant of health and health seeking behavior. Education is strongly positively correlated with income, urban living, exposure to modernity and media, and empowerment (in the case of women), all of which are positive factors for good health and well-being. Hence, it is imperative for all governments to invest on education to raise the overall standard of living which will also lead to reduction of health problems. The *education policy* should be an integral part of the national development policy, and it should be linked with human resource policy and health policy in terms of training of health personnel, including the specialists. There is also a need to step up informal education for the out of school and to provide health related information through the media, including the use of information and communications technology (ICT). The government may also consider introducing an appropriate reproductive and sex education programs that instill responsible sexual behavior and enhance knowledge of contraception to prevent pregnancy among the adolescents.

Declines in fertility and mortality have resulted in population ageing with the attendant problems of rapidly rising chronic diseases. The *family planning programs* which have contributed much to fertility reduction should be continued or revitalized, with shifts in the thrust to beyond family planning. Besides providing contraceptive information and services, family planning programs should provide a broader range of services, including bio-medical research, infertility treatment, the sexual and reproductive health needs of adolescents, the unmarried, men and older people (including treatment for menopause

and andopause). Efforts must be made to reduce the unmet need among the poor and the marginalized groups. A high proportion of contraceptive users rely on traditional methods. Hence, efforts must be made to encourage the switch to modern methods, or to use natural family planning methods more effectively.

The family, in particular the husband, plays a major role in family planning and use of health facilities. Hence there is a need for *family development policy* with programs aimed at involving the family and promoting male participation in reproductive health and health care decision. Incompatibility between work and maternal role has probably contributed to low fertility, and attempts to pop up the fertility level have proven to be futile. As working women are struggling to cope with work and maternal role, *family development programs* should prioritize work-life balance by engaging with the private sector.

There is a need to improve the data collection and evaluation mechanism to facilitate constant evaluation of the effectiveness of the health programs in improving reproductive health and in reducing NCDs. Data from the vital registration system should be augmented with data collected from sample surveys such as the National Health and Morbidity Surveys.

4.3.2 Recommendations for Research on Health in Malaysia

In Malaysia, research on many elements of reproductive health such as infertility, unmet need for contraception, adolescent sexuality, unsafe abortion, domestic and gender based violence, child health and mortality, men's health and mental health is still lacking. There is also a dearth of research on the utilization of health services among Malaysians and foreign workers in the country. Data collected from vital registration system and from

sample surveys such as the National Health and Morbidity Surveys by the Ministry of Health, and the Malaysian Population and Family Surveys and Youth Sexuality Surveys conducted by the National Population and Family Development Board (NPFDB) should be made available to researchers who may collaborate with officials from the relevant departments in carrying out in-depth analysis.

Evidence points to an increasing trend of abortion, including unsafe abortion among married and unmarried women. There is a need to develop a registration system to collect data on induced abortion from the providers. A survey on abortion should be carried out to examine the profiles of abortion seekers and the providers, the frequency of abortion, and the causes and consequences of abortion including post-abortion complications (and management of the complications) and stigma of abortion.

As the fertility level in Malaysia has declined to replacement level, there is a need to monitor the demographic trend. Exploring fertility preferences in relation to contraceptive use can increase the understanding of future reproductive behavior and unmet family planning needs (Withers, Kano & Pinatih, 2010).

The thesis has demonstrated wide inequalities in health status and use of health facilities across regions, ethnic groups, gender and socio-economic groups. In-depth analysis on the socio-economic differentials and barriers to the use of health facilities should be carried out to identify the groups that are in need of assistance for effective intervention.

Various elements of reproductive health are closely inter-related. For instance, unsafe abortion and HIV are closely linked with ineffective or non-use of contraception. NCDs

are mainly caused by modifiable factors such as inactivity, over consumption of salt, sugar and oil and unhealthy alcohol and tobacco consumption, which lead to obesity, high cholesterol and HBP, and diabetes, and in turn cause other NCDs such as dementia, cardiovascular diseases and cancer. Hence, there is a need to have a good understanding of such linkages in health research. In studying NCDs, it will be of great relevance to include modifiable risk factors.

There is a need for interdisciplinary research involving researchers from health sciences, social sciences, sport science, legal practice, education, religion, ICT, and etcetera. Such collaborative research will ensure a more holistic approach to health research. Action oriented research involving all the stakeholders should be prioritized and supported.

Researchers are often constrained by the lack of secondary data and the financial resources to collect primary data. They may consider using data from other countries that are available to the public. These include data from DHS, Integrated Public Use Microdata Series (IPUMS) and China Longitudinal Health and Longevity Survey (CLHLS). The findings from analyses of these data sets will contribute to knowledge enhancement and may provide valuable lessons for Malaysia.

Socio-economic programs implemented to benefit the public are rarely evaluated in terms of their achievement of the stated objectives. There is therefore a need for evaluative studies on the effectiveness of programs. Findings from such studies can be used to identify the strengths and weaknesses so that certain successful programs can be scaled up and others modified or discontinued.

Most research are based on cross-sectional data and hence the causality of variables must be interpreted with caution. Some attention should be given to the collection of longitudinal data to provide more accurate assessment of the changes over time. The Ministry of Health may consider longitudinal studies involving collection of data from mid-life subjects and follow them through for the future disease, in line with the life course approach. Multivariate analysis including baseline measures such as birth weight and childhood socio-economic position can be carried out to ascertain the temporal relationship between variables over the life span.

A pool of trained researchers are needed to carry out high quality research in various fields, including health. Institutions of higher learning should collaborate with government agencies to train the researchers to conduct proper surveys and statistical data analysis. These researchers should be exposed to the latest survey research techniques and research methodologies. Research should also be updated using the latest method, such as the 2015 revised framework on the proximate determinants of fertility by Bongaarts.

Finally there is a need to ensure that findings from the research are disseminated through publications and presentations. Executive summaries and policy briefs may be effective in reaching the policy makers and the public. Key findings from the research may be reported in the print or social media.

4.4 Research Contributions

Most studies are based on small sample size covering small geographical areas, as national level data are not readily available. Out of the five articles included in this thesis, four are based on nationally representative samples. Findings based on large national samples are likely to be more representative of the study populations, and this may be considered a strength for this thesis.

The thesis covers important reproductive and public health issues that are the main targets of Programme of Action (PoA) of the International Conference on Population and Development (ICPD), MDGs and SDGs. Three of the articles focus on the reproductive health of women of childbearing ages, and two are on the older population inflicted with NCDs. In each article, findings from the present study are compared with those of past studies to highlight the commonalities and differences. It is hoped that articles included in this thesis can contribute to the literature on proximate determinants of fertility, medical students' perception towards abortion education, the correlates of and barriers to the utilization of health services for delivery in two regions where MDGs target on universal access to reproductive health services are way off track, and on the prevalence of NCD and disability.

Bongaarts' model for estimating the relative contribution of the four main proximate determinants of fertility has been used extensively with hundreds of published articles. The article on proximate determinants of fertility in Peninsular Malaysia will add to the literature on this subject for international comparisons. This article has filled the gap on research on the proximate determinants of fertility in Malaysia. It is one of the few that have demonstrated the differential roles of the proximate determinants in fertility

reduction among different ethnic groups within the same country for deepening the understanding of the reasons behind the fertility transition. As data on induced abortion is not available in Malaysia, the indirect estimate on the total abortion rate provides a useful indication of the prevalence of induced abortion in Malaysia, although it probably represents an under-estimate of the actual situation.

Owing to the unavailability of data on induced abortion, research on this subject is lacking in Malaysia. While many studies have been conducted on abortion training in North America and Europe, little has been done in the developing countries on this subject. Past studies show that the medical professionals have a very important role in the provision of safe abortion, and hence there is a need to have a better knowledge on the perceptions of medical students on abortion training and their intention to provide abortion in their future practice. Findings from the paper in this thesis on medical students' perception on abortion education may be used by the relevant authorities in designing abortion training program to increase the number of trained professionals to reduce the number of unsafe abortion.

Past studies have provided ample evidence that non-use of health facilities for delivery is a major cause for maternal morbidity and mortality. The article on "Correlates of and Barriers to the Utilization of Health Services in South Asia and sub-Saharan Africa" contributes to the field by identifying groups that are most at risks, as well as the supply-side and demand-side barriers. Using the rich data from the DHS, this article has included variables such as women's autonomy, exposure to media and family relation, factors that were relatively understudied. The article also highlights the important roles of TBAs and the need to incorporate their services into the health care system. The recommendations

contained in the paper may provide useful inputs for health policies and programs in the developing countries.

One of the major challenges of population aging is meeting the health care needs of rapidly increasing number of older persons who are suffering from chronic diseases and physical limitations. With a rapidly ageing population and epidemiological transition taking place, Malaysia is set to face with the problems of increasing prevalence of NCDs and the attendant problems of the need for long term care. Despite the importance of the NCDs in affecting the health and well-being of the population, in particular the older adults, relatively little research has been done on this topic in Malaysia. The paper on ethnic and gender differentials in NCDs and self-rated health in Malaysia, based on a nationally representative sample, identifies HBP, diabetes, CHD and arthritis as the main NCDs as well as their disabling impact that affect differently the older men and women from various ethnic groups within the country. The relevant authorities may take note of the ethnic and gender differentials in NCDs highlighted in this paper to adopt appropriate intervention strategies to cope with the rising burden of these diseases.

The number of oldest old is growing rapidly, and the prevalence of NCDs rises sharply after age 70. The article on the “Debilitating Effects of Chronic Diseases on the Oldest Old in China” contributes to the literature on disease burden among the oldest old, a neglected group in terms of research on their health problems and physical disability. The rapid rise in the prevalence rate of six major diseases (cardiovascular, neurological, endocrine, respiratory, cancer, and musculoskeletal) and the disabling impact were highlighted. Some diseases such as dementia have very high disabling impact, while others that have lesser disabling impact also contribute to the overall burden because of the high prevalence rate. The study uses data from longitudinal surveys and hence it

contributes to a better understanding of the causal effect of chronic diseases on disability. Some recommendations were put forth in the article for consideration by the relevant authorities.

4.5 Research Limitations

This thesis has several limitations. The articles included in the thesis cover a limited range of topics on public health, focusing on the proximate determinants of fertility, abortion, utilization of health facilities for delivery and NCDs. Many other important reproductive and public health issues such as infertility, domestic and gender based violence, adolescent sexuality, HIV, men's health and mental health are outside the scope of this thesis. Unmet need for contraception, which is an important target under the MDGs, is not included in any of the published articles in this thesis, but the issues are highlighted in the literature review. The paper on abortion has a very limited scope. However, this thesis includes a rather extensive review of literature on attitude toward abortion and abortion education.

The article on proximate determinants of fertility is based on a rather simplistic framework proposed by Bongaarts, using cross-sectional data. The computation of marriage index based on childbearing among married women may be biased in population where childbearing out-of-wedlock is common. Moreover, it is important to take into account the rise in infertility. A number of studies have questioned the validity of Bongaarts' model.

REFERENCES

- Aarssen, L. W. (2005). Why is fertility lower in wealthier countries? The role of relaxed fertility-selection. *Population and Development Review*, 31(1), 113-126.
- Abeynayake, P. B., Bomhoff, E. J., & Lee, G. H. Y. (2012). Female Age at First Marriage and Fertility Levels: A Comparison of Developed and Developing Countries. *SSRN Working Paper Series*.
- Adamchak, D. J., & Mbizvo, M. T. (1994). The impact of husband's and wife's education and occupation on family size in Zimbabwe. *Journal of Biosocial Science*, 26(4), 553-558.
- Adsera, A., & Menendez, A. (2011). Fertility changes in Latin America in periods of economic uncertainty. *Population Studies*, 65(1), 37-56.
- Agarwal, S. K. (2005). Chronic kidney disease and its prevention in India. *Kidney International, Supplement*(98), S41-S45.
- Agha, S., & Carton, T. W. (2011). Determinants of institutional delivery in rural Jhang, Pakistan. *International Journal for Equity in Health*, 10, 31-42.
- Agus, Y., & Horiuchi, S. (2012). Factors influencing the use of antenatal care in rural West Sumatra, Indonesia. *BMC Pregnancy and Childbirth*, 12, 9-16.
- Ahmed, S., Creanga, A. A., Gillespie, D. G., & Tsui, A. O. (2010). Economic Status, Education and Empowerment: Implications for Maternal Health Service Utilization in Developing Countries. *PLoS ONE*, 5(6), e11190.
- Ahmed, S., Li, Q., Liu, L., & Tsui, A. O. (2012). Maternal deaths averted by contraceptive use: an analysis of 172 countries. *Lancet (London, England)*, 380(9837), 111-125.
- Akin, M. S. (2005). Education and Fertility: A Panel Data Analysis for Middle Eastern Countries. *The Journal of Developing Areas*, 39(1), 55-69.
- Aksan, A.-M. (2014). Effects of Childhood Mortality and Morbidity on the Fertility Transition in sub-Saharan Africa. *Population and Development Review*, 40(2), 311-329.
- Ali, A., & Howden-Chapman, P. (2007). Maternity services and the role of the traditional birth attendant, bidan kampung, in rural Malaysia. *Journal of public health management and practice*, 13(3), 278-286.
- Alkema, L., Kantorova, V., Menozzi, C., & Biddlecom, A. (2013). National, regional, and global rates and trends in contraceptive prevalence and unmet need for family planning between 1990 and 2015: a systematic and comprehensive analysis. *Lancet (London, England)*, 381(9878), 1642-1652.
- Allendorf, K. (2007). Couples' Reports of Women's Autonomy and Health-Care Use in Nepal. *Studies in Family Planning*, 38(1), 35-46.
- Amin, R., Shah, N. M., & Becker, S. (2010). Socioeconomic factors differentiating maternal and child health-seeking behavior in rural Bangladesh: A cross-sectional analysis. *International Journal for Equity in Health*, 9, 9-19.
- Amin, S., & Teerawichitchainan, B. (2009). Ethnic Fertility Differentials in Vietnam and Their Proximate Determinants *Poverty, Gender, and Youth Working Paper*.
- Anderson, T., & Kohler, H.-P. (2013). Education Fever and the East Asian Fertility Puzzle. *Asian Population Studies*, 9(2), 196 - 215.
- Angeles, L. (2010). Demographic transitions: analyzing the effects of mortality on fertility. *Journal of Population Economics*, 23(1), 99-120.
- Angkurawaranon, C., Lerssrimonkol, C., Jakkaew, N., Philalai, T., Doyle, P., & Nitsch, D. (2015). Living in an urban environment and non-communicable disease risk in Thailand: Does timing matter? *Health & Place*, 33, 37-47.

- Arokiasamy, P., Uttamacharya, U., & Jain, K. (2013). Multiple Chronic Diseases and Their Linkages with Functional health and Subjective Wellbeing among adults in the low-middle income countries: An Analysis of SAGE Wave1 Data, 2007/10 *IDEAS Working Paper Series*.
- Aspilcueta-Gho, D. (2013). Role of men in contraception, as users and partners. *Revista peruana de medicina experimental y salud publica*, 30(3), 480-486.
- Balal, A. (2009). MSI's impact on fertility decline in Nepal. London, United Kingdom: Marie Stopes International.
- Baschieri, A., & Hinde, A. (2007). The proximate determinants of fertility and birth intervals in Egypt: An application of calendar data. *Demographic Research*, 16(3), 59-96.
- Bashour, H., Abdulsalam, A., Al-Faisal, W., & Cheikha, S. (2008). Patterns and determinants of maternity care in Damascus. *Eastern Mediterranean Health Journal*, 14(3), 595-604.
- Batty, G. D., Alves, J. G., Correia, J., & Lawlor, D. A. (2007). Examining life-course influences on chronic disease: the importance of birth cohort studies from low- and middle- income countries. An overview. *Brazilian Journal Of Medical And Biological Research*, 40(9), 1277-1286.
- Becker, D., Garcia, S. G., & Larsen, U. (2002). Knowledge and Opinions about Abortion Law among Mexican Youth. *International Family Planning Perspectives*, 28(4), 205-213.
- Beegle, K., Frankenberg, E., & Thomas, D. (2001). Bargaining power within couples and use of prenatal and delivery care in Indonesia. *Studies in family planning*, 32(2), 130-146.
- Ben-Shlomo, Y., & Kuh, D. (2002). A life course approach to chronic disease epidemiology: conceptual models, empirical challenges and interdisciplinary perspectives. *International Journal of Epidemiology*, 31(2), 285-293.
- Berer, M. (2002). Making Abortions Safe: A Matter of Good Public Health Policy and Practice. *Reproductive Health Matters*, 10(19), 31-44.
- Bertrand, J. T., Sullivan, T. M., Knowles, E. A., Zeeshan, M. F., & Shelton, J. D. (2014). Contraceptive Method Skew and Shifts in Method Mix In Low- and Middle-Income Countries. *International Perspectives on Sexual and Reproductive Health*, 40(3), 144-153.
- Betzig, L. (1997). *Introduction: people are animals*. Oxford, UK: Oxford University Press.
- Bhat, P. N. M., & Zavier, A. J. F. (2005). Role of religion in fertility decline: The case of Indian Muslims. *Economic and Political Weekly*, 40(5), 385-402.
- Blanc, A. K., Tsui, A. O., Croft, T. N., & Trevitt, J. L. (2009). Patterns and trends in adolescents' contraceptive use and discontinuation in developing countries and comparisons with adult women. *International perspectives on sexual and reproductive health*, 35(2), 63-71.
- Bloom, D. E., Canning, D., & Malaney, P. N. (2000). Population dynamics and economic growth in Asia. *Population and Development Review*, 26(Supplement: Population and Economic Change in East Asia), 257-290.
- Bollen, K. A., Glanville, J. L., & Stecklov, G. (2007). Socio-economic status, permanent income, and fertility: A latent-variable approach. *Population Studies*, 61(1), 15-34.
- Bongaarts, J. (1978). A framework for analyzing the proximate determinants of fertility. *Population and Development Review*, 4(1), 105-132.
- Bongaarts, J. (1982). The fertility-inhibiting effects of the intermediate fertility variables. *Stud Family Plann*, 13(6-7), 179-189.

- Bongaarts, J., & Potter, R. G. (1983). *Fertility, Biology, and Behavior. An Analysis of the Proximate Determinants*. New York: Academic Press.
- Borg, M. O. (1989). The income-fertility relationship: Effect of the net price of a child. *Demography*, 26(2), 301-310.
- Boulier, B. L. (1982). Income redistribution and fertility decline: A skeptical view. *Population and Development Review*, 8(Supplement: Income Distribution and the Family), 159-173.
- Breen, S., & Ensor, T. (2011). Contextual influences and individual determinants of skilled attendance at delivery in Zambia: a multivariate analysis of the 2007 Demographic and Health Survey *The Mobilizing Access to Maternal Health Services in Zambia programme*. Lusaka, Zambia: Health Partners International.
- Broeck, G., & Maertens, M. (2015). Female Employment Reduces Fertility in Rural Senegal. *PLoS One*, 10(3), e0122086.
- Buhler, C. (2004). Additional work, family agriculture, and the birth of a first or a second child in Russia at the beginning of the 1990s. *Population Research and Policy Review*, 23(3), 259-289.
- Byrne, A., & Morgan, A. (2011). How the integration of traditional birth attendants with formal health systems can increase skilled birth attendance. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*, 115(2), 127-134.
- Cáceres-delpiano, J. (2012). Can We Still Learn Something From the Relationship Between Fertility and Mother's Employment? Evidence From Developing Countries. *Demography*, 49(1), 151-174.
- Castle, M. A., & Hakim-Elahi, E. (1996). Abortion education for residents. *Obstetrics and gynecology*, 87(4), 626-629.
- Cessford, T. A., & Norman, W. (2011). Making a case for abortion curriculum reform: a knowledge-assessment survey of undergraduate medical students. *Journal of obstetrics and gynaecology Canada*, 33(1), 38-45.
- Chakraborty, N., Islam, M. A., Chowdhury, R. I., Bari, W., & Akhter, H. H. (2003). Determinants of the use of maternal health services in rural Bangladesh. *Health Promotion International*, 18(4), 327-337.
- Cigno, A. (1998). Fertility decisions when infant survival is endogenous. *Journal of Population Economics*, 11(1), 21-28.
- Cleland, J., Bernstein, S., Ezeh, A., Faundes, A., Glasier, A., & Innis, J. (2006). Family planning: the unfinished agenda. *The Lancet*, 368(9549), 1810-1827.
- Cleland, J., Conde-Agudelo, A., Peterson, H., Ross, J., & Tsui, A. (2012). Contraception and health. *The Lancet*, 380(9837), 149-156.
- Coale, A. J. (1984). Rapid population change in China, 1952-1982. Washington DC, USA: National Research Council.
- Cochrane, S. H., & Zachariah, K. C. (1983). Infant and child mortality as a determinant of fertility *World Bank Staff Working Papers*.
- Collumbien, M., Gerressu, M., & Cleland, J. (2004). Non-Use and Use of Ineffective Methods of Contraception. In Ezzati, M., Lopez, A. D., Rodgers, A. & Murray, C. J. L. (Eds.), *Comparative Quantification of Health Risks: Global and Regional Burden of Disease Attributable to Selected Major Risk Factors* (pp. 1255-1320). Geneva: World Health Organization.
- Costa, D. L. (2002). Changing Chronic Disease Rates and Long-Term Declines in Functional Limitation among Older Men. *Demography*, 39(1), 119-137.
- Creanga, A. A., Acharya, R., Ahmed, S., & Tsui, A. O. (2007). Contraceptive discontinuation and failure and subsequent abortion in Romania: 1994-99. *Studies in family planning*, 38(1), 23-34.

- Creanga, A. A., Roy, P., & Tsui, A. O. (2008). Characteristics of abortion service providers in two northern Indian states. *Contraception*, 78(6), 500-506.
- Crowther, N. J. (2012). Early determinants of chronic disease in developing countries. *Best Practice & Research. Clinical Endocrinology & Metabolism*, 26(5), 655-665.
- Da Rocha, J. M., & Fuster, L. (2006). Why Are Fertility Rates and Female Employment Ratios Positively Correlated across O.E.C.D. Countries? *International Economic Review*, 47(4), 1187-1222.
- Das, K. C., Das, K., & Thi Ngoc Lan, N. (2013). *Proximate determinants and their influences on fertility reduction in Vietnam*. Paper presented at the 27th IUSSP International Population Conference Busan, Korea.
- Davis, K., & Blake, J. (1956). Social structure and fertility: An analytic framework. *Economic Development and Cultural Change*, 4(3), 211-235.
- Dayananda, I., Walker, D., Atienzo, E. E., & Haider, S. (2012). Abortion practice in Mexico: a survey of health care providers. *Contraception*, 85(3), 304-310.
- Dehlendorf, C., Brahmi, D., Engel, D., Grumbach, K., Joffe, C., & Gold, M. (2007). Integrating abortion training into family medicine residency programs. *Family medicine*, 39(5), 337-342.
- Delbiso, T. D. (2014). Correlates of Unmet Need for Contraception in Ethiopia: Evidence from 2011 Ethiopian Demographic and Health Survey. *Etude de la Population Africaine*, 28(2), 989-998.
- Department of Reproductive Health and Research, W. H. O. (2011). *Unsafe abortion: Global and regional estimates of the incidence of unsafe abortion and associated mortality in 2008* (6th ed.). Geneva.
- DeRose, L. F., & Ezeh, A. C. (2005). Men's Influence on the Onset and Progress of Fertility Decline in Ghana, 1988-98. *Population Studies*, 59(2), 197-210.
- Durstine, J. L., Gordon, B., Wang, Z., & Luo, X. (2013). Chronic disease and the link to physical activity. *Journal of Sport and Health Science*, 2(1), 3-11.
- Dzudie, A., Kengne, A. P., Muna, W. F., Ba, H., Menanga, A., Kouam Kouam, C., Abah, J., Monkam, Y., Biholong, C., Mintom, P., Kamdem, F., Djomou, A., Ndjebet, J., Wambo, C., Luma, H., Ngu, K. B., Kingue, S., & CCS investigator group. (2012). Prevalence, awareness, treatment and control of hypertension in a selfselected sub-Saharan African urban population: a crosssectional study. *BMJ Open*, 2(4), e001217.
- El-Ghannam, A. R. (2005). An examination of factors affecting fertility rate differentials as compared among women in less and more developed countries. *Journal of Human Ecology*, 18(3), 181-192.
- Engelhardt, H., Kogel, T., & Prskawetz, A. (2004). Fertility and women's employment reconsidered: A macro-level time-series analysis for developed countries, 1960-2000. *Population Studies*, 58(1), 109-120.
- Ensor, T., & Cooper, S. (2004). Overcoming barriers to health service access: influencing the demand side. *Health Policy Plan*, 19(2), 69-79.
- Erfani, A., & Mcquillan, K. (2008). Rapid Fertility Decline in Iran: Analysis of Intermediate Variables. *Journal of Biosocial Science*, 40(3), 459-478.
- Espey, E., Ogburn, T., Chavez, A., Qualls, C., & Leyba, M. (2005). Abortion education in medical schools: a national survey. *American journal of obstetrics and gynecology*, 192(2), 640-643.
- Espey, E., Ogburn, T., Leeman, L., Nguyen, T., & Gill, G. (2008). Abortion education in the medical curriculum: a survey of student attitudes. *Contraception*, 77(3), 205-208.
- Espey, J., & Dolata, N. (2011). *An Equal Start. Why Gender Equality Matters for Child Survival and Maternal Health*. London: Save the Children UK.

- Ezeh, A. C., Mberu, B. U., & Emina, J. O. (2009). Stall in fertility decline in Eastern African countries: regional analysis of patterns, determinants and implications. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 364(1532), 2991-3007.
- Feeney, G., Wang, F., Zhou, M., & Xiao, B. (1989). Recent fertility dynamics in China: Results from the 1987 One Percent Population Survey. *Population and Development Review*, 15(2), 297-322.
- Fine, L. J., Philogene, G. S., Gramling, R., Coups, E. J., & Sinha, S. (2004). Prevalence of multiple chronic disease risk factors. 2001 National Health Interview Survey. *American Journal Of Preventive Medicine*, 27(2 Suppl), 18-24.
- Foster, A. M., Polis, C., Allee, M. K., Simmonds, K., Zurek, M., & Brown, A. (2006). Abortion education in nurse practitioner, physician assistant and certified nurse-midwifery programs: a national survey. *Contraception*, 73(4), 408-414.
- Fotso, J. C., Ezeh, A. C., & Essendi, H. (2009). Maternal health in resource-poor urban settings: how does women's autonomy influence the utilization of obstetric care services? *Reproductive Health*, 6, 9.
- Francome, C., & Freeman, E. (2000). British general practitioners' attitudes toward abortion. *Family planning perspectives*, 32(4), 189-191.
- Furuta, M., & Salway, S. (2006). Women's Position within the Household as a Determinant of Maternal Health Care Use in Nepal. *International Family Planning Perspectives*, 32(1), 17-27.
- Gabrysch, S., & Campbell, O. M. (2009). Still too far to walk: Literature review of the determinants of delivery service use. *BMC Pregnancy and Childbirth*, 9, 34-51.
- Geary, C. W., Gebreselassie, H., Awah, P., & Pearson, E. (2012). Attitudes toward abortion in Zambia. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*, 118 (Suppl 2), S148-S151.
- Gorbach, P. M., Hoa, D. T., Nhan, V. Q., & Tsui, A. (1998). Contraception and abortion in two Vietnamese communes. *American journal of public health*, 88(4), 660-663.
- Govindasamy, P., & Ramesh, B. M. (1997). Maternal Education and the Utilization of Maternal and Child Health Services in India *National Family Health Survey Subject Reports Number 5*. Mumbai, India: International Institute for Population Sciences.
- Gubhaju, B. (2007). Fertility decline in Asia: Opportunities and challenges. *The Japanese Journal of Population*, 5(1), 19-42.
- Gurmu, E., & Mace, R. (2008). Fertility Decline Driven By Poverty: the Case of Addis Ababa, Ethiopia. *Journal of Biosocial Science*, 40(3), 339-358.
- Haider, T. L., & Sharma, M. (2012). Barriers to family planning and contraception uptake in sub-Saharan Africa: a systematic review. *International quarterly of community health education*, 33(4), 403-413.
- Halfon, N., & Hochstein, M. (2002). Life Course Health Development: An Integrated Framework for Developing Health Policy, and Research. *The Milbank Quarterly*, 80(3), 433-479.
- Hammoudeh, W., & Hogan, D. P. (2012). Proximate determinants of Palestinian fertility: a decomposition analysis. *The Lancet*, 380(Special Issue), S20.
- Heaton, T. B. (2011). Does Religion Influence Fertility in Developing Countries. *Population Research and Policy Review*, 30(3), 449-465.
- Heleniak, T. (2010). Causes and Demographic Consequences of Fertility Decline in the Former Soviet Union and Central and Eastern Europe. *Marriage & Family Review*, 46(1-2), 79-106.

- Hirschman, C., & Guest, P. (1990). Multilevel Models of Fertility Determination in Four Southeast Asian Countries: 1970 and 1980. *Demography (pre-2011)*, 27(3), 369-396.
- Hoang, V. M., Byass, P., Dao, L. H., Nguyen, T. K. C., & Wall, S. (2007). Risk factors for chronic disease among rural Vietnamese adults and the association of these factors with sociodemographic variables: findings from the WHO STEPS survey in rural Vietnam, 2005. *Preventing Chronic Disease*, 4(2), 1-10.
- Holcombe, S. J., Berhe, A., & Cherie, A. (2015). Personal Beliefs and Professional Responsibilities: Ethiopian Midwives' Attitudes toward Providing Abortion Services after Legal Reform. *Studies in family planning*, 46(1), 73-95.
- Hotchkiss, J. W., Davies, C., Gray, L., Bromley, C., Capewell, S., & Leyland, A. H. (2011). Trends in adult cardiovascular disease risk factors and their socio-economic patterning in the Scottish population 1995-2008: cross-sectional surveys. *BMJ Open*, 1, e000176.
- Howard, K., White, S., Salkeld, G., McDonald, S., Craig, J. C., Chadban, S., & Cass, A. (2010). Cost-Effectiveness of Screening and Optimal Management for Diabetes, Hypertension, and Chronic Kidney Disease: A Modeled Analysis. *Value in Health*, 13(2), 196-208.
- Hung, W. W., Ross, J. S., Boockvar, K. S., & Siu, A. L. (2011). Recent trends in chronic disease, impairment and disability among older adults in the United States. *BMC Geriatrics*, 11, 47.
- Hwang, A. C., Koyama, A., Taylor, D., Henderson, J. T., & Miller, S. (2005). Advanced practice clinicians' interest in providing medical abortion: results of a California survey. *Perspectives on sexual and reproductive health*, 37(2), 92-97.
- Imboden, M., & Probst-Hensch, N. M. (2013). Biobanking across the phenome - at the center of chronic disease research. *BMC Public Health*, 13, 1094.
- Ir, P., Horemans, D., Souk, N., & Damme, W. V. (2010). Using targeted vouchers and health equity funds to improve access to skilled birth attendants for poor women: a case study in three rural health districts in Cambodia. *BMC Pregnancy and Childbirth*, 10, 1-11.
- Islam, M. M., Mamun, A. A., & Bairagi, R. (1998). Fertility and its proximate determinants in Bangladesh: Evidence from the 1993/94 Demographic and Health Survey. *Asia-Pacific Population Journal*, 13(3), 3-22.
- Islam, N., Islam, M., & Yoshimura, Y. (2014). Practices and determinants of delivery by skilled birth attendants in Bangladesh. *Reproductive Health*, 11, 86.
- Ito, J., Dung, D. T. K., Vuong, M. T., Tuyen, D. G., Vinh, L. D., Huong, N. T., Ngoc, T. B., Ngoc, N. T. B., Hien, M. T., Hao, D. D., Oanh, L. T. K., Lieu, D. T., Fujisawa, M., Kawabata, M., & Shirakawa, T. (2008). Impact and perspective on chronic kidney disease in an Asian developing country: a large-scale survey in North Vietnam, Nephron. *Clinical Practice*, 109(1), c25-c32.
- Jain, A. (1997). Consistency between contraceptive use and fertility in India. *Demography India*, 26(1), 19-36.
- Jain, A. K., & Ross, J. A. (2012). Fertility Differences Among Developing Countries: Are They Still Related to Family Planning Program Efforts and Social Settings? *International Perspectives on Sexual & Reproductive Health*, 38(1), 15-22.
- Jat, T. R., Ng, N., & Sebastian, M. S. (2011). Factors affecting the use of maternal health services in Madhya Pradesh state of India: a multilevel analysis. *International Journal for Equity in Health*, 10(59).
- Jha, V. (2009). Current status of chronic kidney disease care in southeast Asia. *Seminars In Nephrology*, 29(5), 487-496.
- Johnston, H. B., & Hill, K. H. (1996). Induced Abortion in the Developing World: Indirect Estimates. *International Family Planning Perspectives*, 22, 108-114, 137.

- Jones, G. (2007). Delayed marriage and very low fertility in Pacific Asia. *Popul Dev Rev*, 33(3), 453-478.
- Jones, L. E., & Tertilt, M. (2006). An economic history of fertility in the U.S.: 1826-1960. In Rupert, P. (Ed.), *NBER Working Paper Series*. Cambridge, Massachusetts, USA: National Bureau of Economic Research.
- Kabagenyi, A., Jennings, L., Reid, A., Nalwadda, G., Ntozi, J., & Atuyambe, L. (2014). Barriers to male involvement in contraceptive uptake and reproductive health services: a qualitative study of men and women's perceptions in two rural districts in Uganda. *Reproductive health*, 11(1), 21.
- Kabir, A., Ali, R., Islam, M. S., Kawsar, L. A., & Islam, M. A. (2008). A Comparison of Regional Variations of Fertility in Bangladesh. *International Quarterly of Community Health Education*, 29(3), 275-291.
- Kabir, A., Islam, M. S., & Patwari, M. I. (2005). Proximate Determinants of Fertility in Bangladesh. *International Quarterly of Community Health Education*, 24(2), 135-151.
- Kalule-Sabiti, I., Amoateng, A. Y., & Ngake, M. (2014). The Effect of Socio-demographic Factors on the Utilization of Maternal Health Care Services in Uganda. *African Population Studies*, 28(1), 515-525.
- Kano, M., Hotta, M., & Prasad, A. (2013). Inequalities in noncommunicable disease mortality in the ten largest Japanese cities. *Journal Of Urban Health: Bulletin Of The New York Academy Of Medicine*, 90(6), 1041-1052.
- Kasule, J., Mbizvo, M. T., & Gupta, V. (1999). Abortion: attitudes and perceptions of health professionals in Zimbabwe. *The Central African journal of medicine*, 45(9), 239-244.
- Kaufman, J. (1993). The cost of IUD failure in China. *Studies in Family Planning*, 24(3), 194-196.
- Kempe, A., Alwazer, F. N.-A., & Theorell, T. o. (2011). The Role of Demand Factors in Utilization of Professional Care during Childbirth: Perspectives from Yemen. *ISRN Obstetrics and Gynecology*, 2011.
- Kennedy, E., Gray, N., Azzopardi, P., & Creati, M. (2011). Adolescent fertility and family planning in East Asia and the Pacific: a review of DHS reports. *Reproductive health*, 8, 11.
- Kim, E.-J., Yoon, S.-J., Jo, M.-W., & Kim, H.-J. (2013). Measuring the burden of chronic diseases in Korea in 2007. *Public Health*, 127(9), 806-813.
- Kinaro, J., Kimani, M., Ikamari, L., & Ayiamba, E. H. O. (2015). Perceptions and Barriers to Contraceptive Use among Adolescents Aged 15-19 Years in Kenya: A Case Study of Nairobi. *Health*, 7, 85-97.
- Klijs, B., Nusselder, W. J., Looman, C. W., & Mackenbach, J. P. (2011). Contribution of Chronic Disease to the Burden of Disability. *PLoS ONE*, 6(9), e25325.
- Koc, I., Hancioglu, A., & Cavlin, A. (2008). Demographic differentials and demographic integration of Turkish and Kurdish populations in Turkey. *Population Research and Policy Review*, 27(4), 447-457.
- Konje, J. C., & Ladipo, O. A. (1999). Barriers to uptake and use of modern methods of contraception in developing countries. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*, 65(3), 287-294.
- Kravdal, O. (2001). Main and Interaction Effects of Women's Education and Status on Fertility: The Case of Tanzania. *European Journal of Population*, 17(2), 107-136.
- Krueger, H., Williams, D., Ready, A. E., Trenaman, L., & Turner, D. (2013). Improved estimation of the health and economic burden of chronic disease risk factors in Manitoba. *Chronic Diseases And Injuries In Canada*, 33(4), 236-246.

- Lai, S. L., & Tey, N. P. (2014). Socio-economic and Proximate Determinants of Fertility in the Philippines. *World Applied Science Journal*, 31(10), 1828-1836. doi: 10.5829/idosi.wasj.2014.31.10.591
- Lande, R., & Richey, C. (2006). Expanding services for injectables *Population Reports, Series K, No. 6*.
- Lei, X., Yin, N., & Zhao, Y. (2012). Socioeconomic status and chronic diseases: The case of hypertension in China. *China Economic Review*, 23(1), 105-121.
- Levandowski, B. A., Kalilani-Phiri, L., Kachale, F., Awah, P., Kangaude, G., & Mhango, C. (2012). Investigating social consequences of unwanted pregnancy and unsafe abortion in Malawi: the role of stigma. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*, 118(Suppl 2), S167-S171.
- Leventhal, A. M., Huh, J., & Dunton, G. F. (2014). Clustering of modifiable biobehavioral risk factors for chronic disease in US adults: a latent class analysis. *Perspectives In Public Health*, 134(6), 331-338.
- Levey, A. S., Astor, B. C., Stevens, L. A., & Coresh, J. (2010). Chronic kidney disease, diabetes, and hypertension: what's in a name? *Kidney International*, 78(1), 19-22.
- Lima, M. G., Barros, M. B. A., César, C. L. G., Goldbaum, M., Carandina, L., & Ciconelli, R. M. (2009). Impact of chronic disease on quality of life among the elderly in the state of São Paulo, Brazil: a population-based study. *Pan American Journal Of Public Health*, 25(4), 314-321.
- Low, B. (2001). Sex, wealth, and fertility: old rules, new environments. In Cronk, L., Chagon, N. & Irons, W. (Eds.), *Adaptation and human behaviour: an anthropological perspective* (pp. 323-344). New York: Aldline.
- Low, W. Y., Tong, W. T., Wong, Y. L., Jegasothy, R., & Choong, S. P. (2015). Access to safe legal abortion in Malaysia: women's insights and health sector response. *Asia-Pacific journal of public health / Asia-Pacific Academic Consortium for Public Health*, 27(1), 33-37.
- Magnusson, R. S. (2009). Rethinking global health challenges: towards a 'global compact' for reducing the burden of chronic disease. *Public Health*, 123(3), 265-274.
- Mannah, M. T., Warren, C., Kuria, S., & Adegoke, A. A. (2014). Opportunities and challenges in implementing community based skilled birth attendance strategy in Kenya. *BMC Pregnancy and Childbirth*, 14, 279.
- Marston, C., & Cleland, J. (2003). Relationships between contraception and abortion: A review of the evidence. *International family planning perspectives*, 29(1), 6-13.
- Martin, T. C. (1995). Women's education and fertility: Results from 26 Demographic and Health Surveys. *Studies in Family Planning*, 26(4), 187-202.
- Mavaddat, N., Valderas, J. M., van der Linde, R., Khaw, K. T., & Kinmonth, A. L. (2014). Association of self-rated health with multimorbidity, chronic disease and psychosocial factors in a large middle-aged and older cohort from general practice: a cross-sectional study. *BMC Family Practice*, 15, 185.
- Mayer-Foulkes, D. (2010). Non-communicable Chronic Diseases in the Americas: An Economic Perspective on Health Policie *IDEAS Working Paper Series*.
- Mazharul Islam, M., Ataharul Islam, M., & Chakroborty, N. (2004). Fertility Transition in Bangladesh: Understanding the Role of the Proximate Determinants. *Journal of Biosocial Science*, 36(3), 351-369.
- Mboane, R., & Bhatta, M. (2015). Influence of a husband's healthcare decision making role on a woman's intention to use contraceptives among Mozambican women. *Reproductive Health*, 12, 36.
- McNamee, C. B. (2009). Wanted and Unwanted Fertility in Bolivia: Does Ethnicity Matter. *International Perspectives on Sexual & Reproductive Health*, 35(4), 166 - 175.

- Micevska, M. B., & Zak, P. J. (2002). What accounts for the emergence of Malthusian fertility in transition economies? *Claremont Colleges Working Papers in Economics*. California, USA: The Claremont Colleges.
- Moore, A. M., Singh, S., & Bankole, A. (2011). Do women and men consider abortion as an alternative to contraception in the United States? An exploratory study. *Global public health*, 6(Suppl 1), S25-S37.
- Moreland, S., Smith, E., & Sharma, S. (2010). World population prospects and unmet need for family planning. Washington DC, USA: Futures Group.
- Moreno, L. (1991). An Alternative Model of the Impact of the Proximate Determinants on Fertility Change: Evidence From Latin America. *Population Studies*, 45(2), 313-337.
- Morris, E., Unwin, N., Ali, E., Brathwaite-Graham, L., & Samuels, T. A. (2011). Chronic non-communicable disease risk factor survey 2010 among University of the West Indies staff at Cave Hill, Barbados. *The West Indian Medical Journal*, 60(4), 452-458.
- Moses, L. Y. A., & Kayizzi, J. B. (2007). *Using the Bongaarts model in explaining fertility decline in Urban areas of Uganda*. Paper presented at the Fifth African Population Conference, Arusha.
- Mpembeni, R. N., Killewo, J. Z., Leshabari, M. T., Massawe, S. N., Jahn, A., Mushi, D., & Mwakipa, H. (2007). Use pattern of maternal health services and determinants of skilled care during delivery in Southern Tanzania: implications for achievement of MDG-5 targets. *BMC Pregnancy and Childbirth*, 7, 29-35.
- Mturi, A. J., & Hinde, A. (2001). *Fertility levels and differentials in Tanzania*. Paper presented at the Workshop on Prospects for Fertility Decline in High Fertility Countries, New York, USA.
- Myran, D. T., Carew, C. L., Tang, J., Whyte, H., & Fisher, W. A. (2015). Medical students' intentions to seek abortion training and to provide abortion services in future practice. *Journal of obstetrics and gynaecology Canada*, 37(3), 236-244.
- Navaneetham, K., & Dharmalingam, A. (2002). Utilization of maternal health care services in Southern India. *Social Science & Medicine*, 55(10), 1849-1869.
- Ng, N., Hakimi, M., Santosa, A., Byass, P., Wilopo, S. A., & Wall, S. (2012). Is Self-Rated Health an Independent Index for Mortality among Older People in Indonesia? *PLoS ONE*, 7(4), e35308.
- Ng, S. T., Tey, N. P., & Asadullah, M. N. (2017). What matters for life satisfaction among the oldest old? Evidence from China. *PLoS ONE*, 12(2).
- Nishi, A., Kawachi, I., Shirai, K., Hirai, H., Jeong, S., & Kondo, K. (2012). Sex/gender and socioeconomic differences in the predictive ability of self-rated health for mortality. *PLoS ONE*, 7(1), e30179.
- Ochako, R., Mbondo, M., Aloo, S., Kaimenyi, S., Thompson, R., Temmerman, M., & Kays, M. (2015). Barriers to modern contraceptive methods uptake among young women in Kenya: a qualitative study. *BMC Public Health*, 15, 118.
- Ogland, C. P., & Verona, A. P. (2011). Religion and Attitudes Toward Abortion and Abortion Policy in Brazil. *Journal for the Scientific Study of Religion*, 50(4), 812-821.
- Okigbo, C., Speizer, I., Corroon, M., & Gueye, A. (2015). Exposure to family planning messages and modern contraceptive use among men in urban Kenya, Nigeria, and Senegal: a cross-sectional study. *Reproductive Health*, 12, 63.
- Okonofua, F. (2006). Abortion and maternal mortality in the developing world. *Journal of obstetrics and gynaecology Canada*, 28(11), 974-979.

- Omideyi, A. K., Akinyemi, A. I., Aina, O. I., Adeyemi, A. B., Fadeyibi, O. A., Bamiwuye, S. O., Akinbami, C. A., & Anazodo, A. (2011). Contraceptive practice, unwanted pregnancies and induced abortion in Southwest Nigeria. *Global public health*, 6(Suppl 1), S52-S72.
- Onuoha, N. (1992). Contributions of the proximate determinants to fertility change in Senegal. *Social Science & Medicine*, 35(10), 1317-1320.
- Opoku, E. A. (2009). *Utilization of Maternal Care services in Ghana by Region after the Implementation of the Free Maternal Care Policy*. Master of Public Health (Health Management and Policy), University of North Texas Health Science Center, Fort Worth, Texas.
- Owonikoko, K. M., Okunlola, M. A., Adeleke, A. O., & Akinboade, A. F. (2012). Fertility regulation among women of reproductive age in Ibadan, south-west Nigeria: contraception, abortion or both. *The Nigerian postgraduate medical journal*, 19(1), 25-29.
- Oyerinde, K., Harding, Y., Amara, P., Garbrah-Aidoo, N., Kanu, R., Oulare, M., Shoo, R., & Daoh, K. (2013). A qualitative evaluation of the choice of traditional birth attendants for maternity care in 2008 Sierra Leone: implications for universal skilled attendance at delivery. *Maternal and child health journal*, 17(5), 862-868.
- Pachauri, S. (1994). Relationship between AIDS and family planning programmes: a rationale for developing integrated reproductive health services. *Health transition review : the cultural, social, and behavioural determinants of health*, 4(Suppl), 321-347.
- Palazzo, C., Ravaud, J.-F., Trinquart, L., Dalichampt, M., Ravaud, P., & Poiraudau, S. (2012). Respective Contribution of Chronic Conditions to Disability in France: Results from the National Disability-Health Survey. *PLoS ONE*, 7(9), e44994.
- Patel, C. J., & Kooverjee, T. (2009). Abortion and contraception: attitudes of South african university students. *Health care for women international*, 30(6), 550-568.
- Patel, L., Bennett, T. A., Halpern, C. T., Johnston, H. B., & Suchindran, C. M. (2009). Support for provision of early medical abortion by mid-level providers in Bihar and Jharkhand, India. *Reproductive health matters*, 17(33), 70-79.
- Patil, A. V., Somasundaram, K. V., & Goyal, R. C. (2002). Current health scenario in rural India. *Australian Journal of Rural Health*, 10(2), 129-135.
- Perkovic, V., Cass, A., Patel, A. A., Suriyawongpaisal, P., Barzi, F., Chadban, S., Macmahon, S., & Neal, B. (2008). High prevalence of chronic kidney disease in Thailand. *Kidney International*, 73(4), 473-479.
- Perruccio, A. V., Katz, J. N., & Losina, E. (2012). Health burden in chronic disease: multimorbidity is associated with self-rated health more than medical comorbidity alone. *Journal of Clinical Epidemiology*, 65(1), 100-106.
- Phillips, J. F., Greene, W. L., & Jackson, E. F. (1999). Lessons from community-based distribution of family planning in Africa *Policy Research Division Working Paper*. New York: Population Council.
- Piccolo, R. S., Yang, M., Bliwise, D. L., Yaggi, H. K., & Araujo, A. B. (2013). Racial and socioeconomic disparities in sleep and chronic disease: results of a longitudinal investigation. *Ethnicity & Disease*, 23(4), 499-507.
- Pietiläinen, O., Laaksonen, M., Rahkonen, O., & Lahelma, E. (2011). Self-Rated Health as a Predictor of Disability Retirement – The Contribution of Ill-Health and Working Conditions. *PLoS ONE*, 6(9), e25004.
- Population Reference Bureau. (2002). Family planning worldwide 2002 data sheet. Washington, DC: Population Reference Bureau.
- Poston Jr., D. L. (1986). Patterns of contraceptive use in China. *Studies in Family Planning*, 17(5), 217-227.

- Prata, N., Sreenivas, A., & Bellows, B. (2008). Potential of dual-use policies to meet family planning and HIV prevention needs: a case study of Zimbabwe and Mozambique. *The journal of family planning and reproductive health care / Faculty of Family Planning & Reproductive Health Care, Royal College of Obstetricians & Gynaecologists*, 34(4), 219-226.
- Rahayu, R., Utomo, I., & McDonald, P. (2009). *Contraceptive use pattern among married women in Indonesia*. Paper presented at the International Conference on Family Planning: Research and Best Practices, Kampala, Uganda.
- Rahman, M., DaVanzo, J., & Razzaque, A. (2001). Do better family planning services reduce abortion in Bangladesh? *Lancet (London, England)*, 358(9287), 1051-1056.
- Rahman, M., Haque, S. E., Mostofa, M. G., Tarivonda, L., & Shuaib, M. (2011). Wealth inequality and utilization of reproductive health services in the Republic of Vanuatu: insights from the multiple indicator cluster survey, 2007. *International Journal for Equity in Health*, 10, 58-67.
- Rashedul Islam, M., Nurul Islam, M., Monsur Rahman, M., Golam Hossain, M., & Rafiqul Islam, M. (2015). Fertility Situation in Bangladesh: Application of Revised Bongaarts Model. *Science and Technology*, 5(2), 33-38.
- Reinis, K. I. (1992). The Impact of the Proximate Determinants of Fertility: Evaluating Bongaarts's and Hobcraft and Little's Methods of Estimation. *Population Studies*, 46(2), 309-326.
- Ribeiro Sarmiento, D. (2014). Traditional Birth Attendance (TBA) in a health system: what are the roles, benefits and challenges: A case study of incorporated TBA in Timor-Leste. *Asia Pacific Family Medicine*, 13(1), 12.
- Rosenblatt, R. A., Robinson, K. B., Larson, E. H., & Dobie, S. A. (1999). Medical students' attitudes toward abortion and other reproductive health services. *Family medicine*, 31(3), 195-199.
- Rosenzweig, M. R. (1990). Population growth and human capital investments: Theory and evidence. *Journal of Political Economy*, 98(5, Part 2: The Problem of Development: A Conference of the Institute for the Study of Free Enterprise Systems), S38-S70.
- Ross, J., Hardee, K., Mumford, E., & Eid, S. (2002). Contraceptive Method Choice in Developing Countries. *International Family Planning Perspectives*, 28(1), 32-40.
- Ross, J. L., Blangero, J., Goldstein, M. C., & Schuler, S. (1986). Proximate determinants of fertility in the Kathmandu Valley, Nepal: An anthropological case study. *Journal of Biosocial Science*, 18(2), 179-196.
- Roy, G., Parvataneni, R., Friedman, B., Eastwood, K., Darney, P. D., & Steinauer, J. (2006). Abortion training in Canadian obstetrics and gynecology residency programs. *Obstetrics and gynecology*, 108(2), 309-314.
- Rydwik, E., Welmer, A.-K., Angleman, S., Fratiglioni, L., & Wang, H.-X. (2013). Is Midlife Occupational Physical Activity Related to Disability in Old Age? The SNACKungsholmen Study. *PLoS ONE*, 8(7), e70471.
- Sarfraz, M., & Hamid, S. (2014). Challenges in delivery of skilled maternal care - experiences of community midwives in Pakistan. *BMC pregnancy and childbirth*, 14, 59.
- Sasaki, Y., Marioni, R., Kasai, M., Ishii, H., Yamaguchi, S., & Meguro, K. (2011). Chronic kidney disease: a risk factor for dementia onset: a population-based study. The Osaki-Tajiri Project. *Journal Of The American Geriatrics Society*, 59(7), 1175-1181.

- Saxena, P. C. (2005). *Why is Fertility Transition Slowest in Yemen among the Arab States? Some Clues from the Analysis of Proximate Determinants of Fertility*. Paper presented at the Population Association of America 2005 Annual Meeting Program, Philadelphia, Pennsylvania.
- Sedgh, G., Ashford, L. S., & Hussain, R. (2016). *Unmet Need for Contraception in Developing Countries: Examining Women's Reasons For Not Using a Method*. New York: Guttmacher Institute.
- Sedgh, G., Hussain, R., Bankole, A., & Singh, S. (2007). *Women with an Unmet Need for Contraception in Developing Countries and Their Reasons for Not Using a Method Occasional Report No. 37*. New York: Guttmacher Institute.
- Sedgh, G., Singh, S., Shah, I. H., Åhman, E., Henshaw, S. K., & Bankole, A. (2012). Induced abortion: incidence and trends worldwide from 1995 to 2008. *Lancet*, 379(9816), 625–632.
- Seiber, E. E., Bertrand, J. T., & Sullivan, T. M. (2007). Changes in Contraceptive Method Mix in Developing Countries. *International Family Planning Perspectives*, 33(3), 117–123.
- Shahjahan, M., Mumu, S., Afroz, A., Chowdhury, H., Kabir, R., & Ahmed, K. (2013). Determinants of male participation in reproductive healthcare services: a cross-sectional study. *Reproductive Health*, 10, 27.
- Shaikh, B. T., Azmat, S. K., & Mazhar, A. (2013). Family Planning and Contraception in Islamic Countries: A Critical Review of the Literature. *Journal of Pakistan Medical Association*, 63(4 Suppl. 3), S-67-S-72.
- Shariff, A., & Singh, G. (2002). *Determinants of Maternal Health Care Utilisation in India: Evidence from a Recent Household Survey*. New Delhi: Registrar and Secretary, National Council of Applied Economic Research.
- Sherina, M. S., Rampal, L., & Mustaqim, A. (2004). Factors associated with chronic illness among the elderly in a rural community in Malaysia. *Asia-Pacific Journal Of Public Health / Asia-Pacific Academic Consortium For Public Health*, 16(2), 109-114.
- Shi, L. (1990). *Family planning policy and socioeconomic factors affecting fertility in China*. Doctor of Philosophy, University of California, Berkeley, California, USA.
- Shibusawa, T., & Padgett, D. (2009). The experiences of “aging” among formerly homeless adults with chronic mental illness: A qualitative study. *Journal of Aging Studies*, 23(3), 188-196.
- Shoham, D. A., Vupputuri, S., & Kshirsagar, A. V. (2005). Chronic kidney disease and life course socioeconomic status: a review. *Advances In Chronic Kidney Disease*, 12(1), 56-63.
- Shotorbani, S., Zimmerman, F. J., Bell, J. F., Ward, D., & Assefi, N. (2004). Attitudes and intentions of future health care providers toward abortion provision. *Perspectives on sexual and reproductive health*, 36(2), 58-63.
- Sibanda, A., Woubalem, Z., Hogan, D. P., & Lindstrom, D. P. (2003). The Proximate Determinants of the Decline to Below-replacement Fertility in Addis Ababa, Ethiopia. *Studies in Family Planning*, 34(1), 1-7.
- Sibanda, A., Woubalem, Z., Hogan, D. P., & Lindstrom, D. P. (2003). The Proximate Determinants of the Decline to Below-Replacement Fertility in AddisAbaba, Ethiopia. *Studies in Family Planning*, 34(1), 1-7.
- Singh, S., Casterline, J. B., & Cleland, J. G. (1985). The Proximate Determinants of Fertility: Sub-national Variations. *Population Studies*, 39(1), 113-135.
- Singh, S., Darroch, J. E., & Ashford, L. S. (2014). *Adding It Up: The Costs and Benefits of Investing in Sexual and Reproductive Health 2014*. New York: Guttmacher Institute.

- Singh, S., Darroch, J. E., Vlassof, M., & Nadeau, J. (2003). *Adding It Up: The Benefits of Investing in Sexual and Reproductive Health Care*. New York: Alan Guttmacher Institute.
- Sjostrom, S., Essen, B., Syden, F., Gemzell-Danielsson, K., & Klingberg-Allvin, M. (2014). Medical students' attitudes and perceptions on abortion: a cross-sectional survey among medical interns in Maharashtra, India. *Contraception*, 90(1), 42-46.
- Skirbekk, V. (2008). Fertility trends by social status. *Demographic Research*, 18(5), 145-180.
- Sousa, R. M., Ferri, C. P., Acosta, D., Albanese, E., Guerra, M., Huang, Y., Jacob, K. S., Jotheeswaran, A. T., Rodriguez, J. J., Pichardo, G. R., Rodriguez, M. C., Salas, A., Sosa, A. L., Williams, J., Zuniga, T., & Prince, M. (2009). Contribution of chronic diseases to disability in elderly people in countries with low and middle incomes: a 10/66 Dementia Research Group population-based survey. *Lancet*, 374(9704), 1821-1830.
- Soyibo, A. K., Roberts, L., & Barton, E. N. (2011). Chronic kidney disease in the Caribbean. *The West Indian Medical Journal*, 60(4), 464-470.
- Srivastava, R. K., & Bansal, R. K. (1996). Please use the health services-more and more. *World Health Forum*, 17(2), 165-168.
- Stanford, J. B., & Smith, K. R. (2013). Marital Fertility and Income: Moderating Effects of the Church of Jesus Christ of Latter-Day Saints Religion in Utah. *Journal of Biosocial Science*, 45(2), 239-248.
- Stein, A. D., Thompson, A. M., & Waters, A. (2005). Childhood growth and chronic disease: evidence from countries undergoing the nutrition transition. *Maternal & Child Nutrition*, 1(3), 177-184.
- Steinauer, J., Landy, U., Filippone, H., Laube, D., Darney, P. D., & Jackson, R. A. (2008). Predictors of abortion provision among practicing obstetrician-gynecologists: a national survey. *American journal of obstetrics and gynecology*, 198(1), 39.e31-36.
- Steinauer, J. E., Landy, U., Jackson, R. A., & Darney, P. D. (2003). The effect of training on the provision of elective abortion: a survey of five residency programs. *American journal of obstetrics and gynecology*, 188(5), 1161-1163.
- Steinauer, J. E., Landy, U., Leon, K., & Darney, P. (2001). Provision of elective abortion among recently graduated obstetrician-gynecologists: does training matter? *Obstetrics & Gynecology*, 97(4, Supplement 1), S57.
- Stover, J. (1998). Revising the proximate determinants of fertility framework: What have we learned in the past 20 years? *Studies in Family Planning*, 29(3), 255-267.
- Sullivan, T. M., Bertrand, J. T., Rice, J., & Shelton, J. D. (2006). Skewed contraceptive method mix: why it happens, why it matters. *Journal of Biosocial Science*, 38(4), 501-521.
- Tee, S. R., Teoh, X. Y., Wan Mohd Aiman, W. A. R., Aiful, A., Siu, C. Y. H., Tan, Z. F., & Khan, A. R. (2010). The Prevalence Of Hypertension And Its Associated Risk Factors In Two Rural Communities In Penang, Malaysia. *International e-Journal of Science, Medicine & Education*, 4(2), 27-40.
- Tey, N. P., & Lai, S. L. (2013). Correlates of and Barriers to the Utilization of Health Services for Delivery in South Asia and Sub-Saharan Africa. *The Scientific World Journal*, 2013(Article ID 423403), 1-11. doi: 10.1155/2013/423403
- Tey, N. P., Lai, S. L., & Teh, J. K. L. (2016). The debilitating effects of chronic diseases among the oldest old in China. *Maturitas*, 94, 39-45.
- Tey, N. P., Ng, S. T., & Yew, S. Y. (2012). Proximate Determinants of Fertility in Peninsular Malaysia. *Asia-Pacific Journal of Public Health*, 24(3), 495-505. doi: 10.10539511401374

- Tey, N. P., Yew, S. Y., Low, W. Y., Su'ut, L., Renjhen, P., Huang, M. S. L., Tong, W. T., & Lai, S. L. (2012). Medical Students' Attitudes toward Abortion Education: Malaysian Perspective. *PLoS ONE*, 7(12), e52116. doi: 10.1371/journal.pone.0052116
- Thapa, S., Sharma, S. K., & Khatiwada, N. (2014). Women's knowledge of abortion law and availability of services in Nepal. *Journal of biosocial science*, 46(2), 266-277.
- Thatte, N., Mullany, L. C., Khatry, S. K., Katz, J., Tielsch, J. M., & Darmstadt, G. L. (2009). Traditional birth attendants in rural Nepal: knowledge, attitudes and practices about maternal and newborn health. *Global public health*, 4(6), 600-617.
- Tsui, A. O. (2012). Family Planning Programmes in Asia and the Pacific and Achieving Millennium Development Goal 5 in Family Planning in Asia & the Pacific: Addressing the Challenges In Zaman, W., Masnin, H. & Loftus, J. (Eds.), (pp. 39-60): International Council on Management of Population Programmes (ICOMP).
- Tsui, A. O., Casterline, J., Singh, S., Bankole, A., Moore, A. M., Omideyi, A. K., Palomino, N., Sathar, Z., Juarez, F., & Shellenberg, K. M. (2011). Managing unplanned pregnancies in five countries: perspectives on contraception and abortion decisions. *Global public health*, 6(Suppl 1), S1-S24.
- Tsui, A. O., McDonald-Mosley, R., & Burke, A. E. (2010). Family planning and the burden of unintended pregnancies. *Epidemiologic reviews*, 32, 152-174.
- Tu, P. (1995). IUD discontinuation patterns and correlates in four Counties in North China. *Studies in Family Planning*, 26(3), 169-179.
- Turquet, L., Watt, P., & Sharman, T. (2008). Hit or Miss? Women's Rights and the Millennium Development Goals. London: ActionAid UK.
- Turvey, C. L., Schultz, S. K., Beglinger, L., & Klein, D. M. (2009). A longitudinal community-based study of chronic illness, cognitive and physical function, and depression. *The American Journal Of Geriatric Psychiatry*, 17(8), 632-641.
- UN. (1994). Programme of Action of the International Conference on Population and Development. Geneva: United Nations.
- UN. (2014). Framework of Actions for the follow-up to the Programme of Action of the International Conference on Population and Development (ICPD) Beyond 2014. Geneva: United Nations.
- UN. (2015a). The Millennium Development Goals Report, 2015. New York: United Nations.
- UN. (2015b). Transforming Our World: The 2030 Agenda for Sustainable Development.
- UNFPA. (2005). Maternal Mortality Update 2004: Delivering into Good Hands. New York: UNFPA.
- UNFPA. (2007). Maternal mortality figures show limited progress in making motherhood safer. New York: UNFPA.
- UNFPA Cambodia. (2005). Obstacles to Deliveries by Trained Health Providers to Cambodian Rural Women Retrieved 8 March, 2017, from <http://www.un.org.kh/unfpa/docs/Obstacles.pdf>
- United Nations. (1994). Programme of Action of the International Conference on Population and Development.
- United Nations Population Division. (2015). Trends in Contraceptive Use Worldwide 2015. New York: United Nations.
- van den Brink, M. J., Boersma, A. A., Meyboom-de Jong, B., & de Bruijn, J. G. M. (2011). Attitude toward contraception and abortion among Curaçao women. Ineffective contraception due to limited sexual education? *BMC Family Practice*, 12, 55.
- van Ginneken, J., & Razzaque, A. (2003). Supply and Demand Factors in the Fertility Decline in Matlab, Bangladesh in 1977-1999. *European Journal of Population*, 19(1), 29.

- Veron, J., Horko, K., Kneipp, R., & Rogers, G. (2008). The demography of South Asia from the 1950s to the 2000s: A summary of changes and a statistical assessment. *Population (English Ed., 2002-)*, 63(1), 9-89.
- Visaria, L. (1999). Proximate Determinants of Fertility in India: An Exploration of NFHS Data. *Economic and Political Weekly*, 34(42/43), 3033-3040.
- Visaria, L., Ramachandran, V., Ganatra, B., & Kalyanwala, S. (2004). Abortion in India: Emerging Issues from Qualitative Studies. *Economic and Political Weekly*, 39(46/47), 5044-5052.
- Vlassoff, M., Jerman, J., Beninuisse, G., Kamgaing, F., & Zinvi-Dossou, F. (2014). Benefits of meeting the contraceptive needs of Cameroonian women. *Issues in brief (Alan Guttmacher Institute)*(1), 1-13.
- Vlassoff, M., Sundaram, A., Bankole, A., Remez, L., & Belemsaga-Yugbare, D. (2011). Benefits of meeting women's contraceptive needs in Burkina Faso. *Issues in brief (Alan Guttmacher Institute)*(1), 1-33.
- Vlassoff, M., & Tsoka, M. (2014). Benefits of Meeting the Contraceptive Needs of Malawian Women. *Issues in brief (Alan Guttmacher Institute)*(2), 1-8.
- Warren, C. W., Johnson, J. T., Gule, G., Hlophe, E., & Kraushaar, D. (1992). The Determinants of Fertility in Swaziland. *Population Studies*, 46(1), 5-17.
- WHO. (2014). Global Status Report on Noncommunicable Diseases 2014. Geneva, Switzerland: World Health Organization.
- Wild, K., Barclay, L., Kelly, P., & Martins, N. (2010). Birth choices in Timor-Leste: a framework for understanding the use of maternal health services in low resource settings. *Social Science & Medicine*, 71(11), 2038-2045.
- Wilunda, C., Quaglio, G., Putoto, G., Takahashi, R., Calia, F., Abebe, D., Manenti, F., Dalla Riva, D., Betran, A. P., & Atzori, A. (2015). Determinants of utilisation of antenatal care and skilled birth attendant at delivery in South West Shoa Zone, Ethiopia: a cross sectional study. *Reproductive Health*, 12, 74.
- Withers, M., Kano, M., & Pinatih, G. N. (2010). Desire for more children, contraceptive use and unmet need for family planning in a remote area of Bali, Indonesia. *Journal of biosocial science*, 42(4), 549-562.
- Witter, S., Arhinful, D. K., Kusi, A., & Zakariah-akoto, S. (2007). The Experience of Ghana in Implementing a User Fee Exemption Policy to Provide Free Delivery Care. *Reproductive Health Matters*, 15(30), 61-71.
- Woldemicael, G. (2007). Do women with higher autonomy seek more maternal and child health-care? Evidence from Ethiopia and Eritrea *MPIDR WORKING PAPER WP 2007-035*. Germany: Max Planck Institute for Demographic Research.
- Woldemicael, G. (2009). Women's Autonomy and Reproductive Preferences in Eritrea. *Journal of Biosocial Science*, 41(2), 161-181.
- Worku, A. G., Yalew, A. W., & Afework, M. F. (2014). The contributions of maternity care to reducing adverse pregnancy outcomes: a cohort study in Dabat district, northwest Ethiopia. *Maternal and child health journal*, 18(6), 1336-1344.
- Yam, E. A., Dries-Daffner, I., & Garcia, S. G. (2006). Abortion opinion research in Latin America and the Caribbean: a review of the literature. *Studies in family planning*, 37(4), 225-240.
- Zere, E., Oluwole, D., Kirigia, J. M., Mwikisa, C. N., & Mbeeli, T. (2011). Inequities in skilled attendance at birth in Namibia: A decomposition analysis. *BMC Pregnancy and Childbirth*, 11, 34-43.
- Zhang, G. (2004). *China's far below replacement level fertility: A reality or illusion arising from underreporting of births?* Doctor of Philosophy, Australian National University, Canberra, Australia.

LIST OF PUBLICATIONS AND PAPERS PRESENTED

Journal Articles

1. Aziz, N. L., Tey, N. P., & Ramli, O. (1980). Malaysia- East Asia Review. Studies in Family Planning, 11(11).
2. Abu Bakar, N. L., Tan, B. A., & Tey, N. P. (1984). Preferences for Number and Sex of Children in the Rural Areas of Peninsular Malaysia. Southeast Asian Journal of Social Science, 12(2).
3. Tan, B. A., & Tey, N. P. (1984). Estimating the Impact of Malaysian Family Planning Programme on Births: A Comparison of Matched Acceptor and Non-acceptor Birth Rates. Malaysian Journal of Reproductive Health, 2(2), 111-118.
4. Ang, E. S., & Tey, N. P. (1984). Health and Family Planning Survey in Jorhor and Perak. Malaysian Journal of Reproductive Health, 1(1).
5. Tey, N. P. (1985). Evaluation of the Effectiveness of IEC Materials. Malaysian Journal of Reproductive Health, 1(1).
6. Tey, N. P., Tan, B. A., & Arshat, H. (1985). Voluntary Sterilization: An Analysis based on Service Statistics of the National Program. Malaysian Journal of Reproductive Health, 3(2), 160-166.
7. Arshat, H., Tan, B. A., & Tey, N. P. (1985). Differential Utilization of Health Facilities and Services for Childbirth in Peninsular Malaysia - The Ethnic Factor. Malaysian Journal of Reproductive Health, 3(2).
8. Tey, N. P., Tan, B. A., & Arshat, H. (1985). Multivariate Areal Analyses of Neo-natal Mortality in Peninsular Malaysia. Malaysian Journal of Reproductive Health, 3(1), 46-58.
9. Arshat, H., Tan, B. A., & Tey, N. P. (1985). The Effects of Life Cycle and Family Formation Variables on Pregnancy Outcome. Malaysian Journal of Reproductive Health, 3(2), 115-125.
10. Tey, N. P., Tan, B. A., & Arshat, H. (1985). Profiles of Family Planning Acceptors in the National Program. Malaysian Journal of Reproductive Health, 3(1), 20-30.
11. Tan, P. C., Kwok, K. K., Tan, B. A., Nagaraj, S., Tey, N. P., & Zulkifli, S. N. (1987). Socio-economic Development and Mortality Patterns and Trends in Malaysia. Asia Pacific Population Journal, 2(1), 3-20.
12. Tey, N. P. (1986). Teenage births on the decline. Malaysian Journal of Reproductive Health, 4(2), 91-96.
13. Salleh, N. M., Tey, N. P., & Arshat, H. (1987). Socioeconomic Correlates of Contraceptive Knowledge among Women in Kuala Lumpur and Petaling Jaya, Malaysia. Malaysian Journal of Reproductive Health, 4(2), 65-71.

14. Arshat, H., & Tey, N. P. (1988). An Overview of the Population Dynamics in Malaysia. *Malaysian Journal of Reproductive Health*, 6(1), 23-46.
15. Arshat, H., Tan, P. C., & Tey, N. P. (1989). The Aging of Population Aging in Malaysia. *Asia Population Studies*, (96).
16. Arshat, H., Tey, N. P., & Ramli, N. (1989). A Study on the Age at Menopause and Menopausal Symptoms Among Malaysian Women. *Malaysian Journal of Reproductive Health*, 7(1), 1-9.
17. Tan, P. C., & Tey, N. P. (1994). Do Fertility Intentions Predict Subsequent Behaviour? Evidence from Peninsular Malaysia. *Studies in Family Planning*, 25(4), 222-231.
18. Haaga, J., Da Vanzo, J., Peterson, C., & Tey, N. P. (1994). Twelve-year Follow-up of Respondents in A Sample Survey in Peninsular Malaysia. *Asia Pacific Population Journal*, 9(2), 61-72.
19. Liaw, S. H., & Tey, N. P. (2002). Academic Performance of Economics Students in the University of Malaya. *Jurnal Pendidikan*, University of Malaya.
20. Tan, P. C., & Tey, N. P. (2005). PJCC- A Model for Community Participation and Active Ageing in Malaysia. *Journal of Intergenerational Relationships*, 3(2), 125-131.
21. Ng, S. T., & Tey, N. P. (2006). Retirement and Perceived Health Status of the Urban Elderly. *Asia Pacific Journal of Public Health*, 18(Suppl.), 9-13.
22. Tey, N. P. (2007). Trends in Delayed and Non-marriage in Peninsular Malaysia. *Asia Population Studies*, 3(3).
23. Aziz, Z., & Tey, N. P. (2009). Herbal Medicines: Prevalence and Predictors of Use among Adult Malaysians. *Complementary Therapies in Medicine*, 17(1), 44-50.
24. Nagaraj, S., Tey, N. P., Ng, C. W., & Balakrishnan, B. (2008). Ethnic Dimensions of Gender Differentials in Mortality in Malaysia. *Journal of Population Research*, 25(2), 183-206.
25. Tey, N. P., Awang, H., & Singaravelloo, K. (2009). Academic and Social Interaction among University of Malaya Students. *Malaysian Journal of Economic Studies*, 46(1), 53-74.
26. Nagaraj, S., Lee, K. H., Tey, N. P., Ng, C. W., & Pala, J. (2009). Counting Ethnicity in Malaysia: The Complexity of Measurement of Diversity. *Malaysian Journal of Economic Studies*, 46(1), 5-32.
27. Ng, S. T., Tengku Aizan, H., & Tey, N. P. (2011). Perceived Health Status and Daily Activities Participation of Older Malaysians. *Asia Pacific Journal of Public Health*, 23(4), 470-484. doi: 10.1177/1010539510374751
28. Yew, S. Y., Yong, C. C., Cheong, K. C., & Tey, N. P. (2011). Does protecting intellectual property rights matter for trade? The case of China's exports to ASEAN-5. *African Journal of Business Management*, 5(2), 524-530.

29. Tey, N. P. (2011). Internal Migration in the Klang Valley of Malaysia: Issues and Implications. *Malaysian Journal of Chinese Studies*, 1, 41-60.
30. Tey, N. P., Ng, S. T., & Yew, S. Y. (2012). Proximate Determinants of Fertility in Peninsular Malaysia. *Asia-Pacific Journal of Public Health*, 24(3), 495-505. doi: 1010539511401374
31. Tey, N. P., Yew, S. Y., Low, W. Y., Su'ut, L., Renjhen, P., Huang, M. S. L., Tong, W. T., & Lai, S. L. (2012). Medical Students' Attitudes toward Abortion Education: Malaysian Perspective. *PLoS ONE*, 7(12), e52116. doi: 10.1371/journal.pone.0052116
32. Choo, W. Y., Walsh, K., Chinna, K., & Tey, N. P. (2013). Teacher Reporting Attitudes Scale (TRAS): Confirmatory and Exploratory Factor Analyses with a Malaysian sample. *J Interpers Violence*, 28(2), 231-253. doi: 10.1177/0886260512454720
33. Choo, W. Y., Walsh, K., Marret, M. J., Chinna, K., & Tey, N. P. (2013). Are Malaysian teachers ready to assume the duties of reporting child abuse and neglect? *Child Abuse Review*, 22(2), 93-107.
34. Tey, N. P., & Lai, S. L. (2013). Correlates of and Barriers to the Utilization of Health Services for Delivery in South Asia and Sub-Saharan Africa. *The Scientific World Journal*, 2013(Article ID 423403), 1-11. doi: 10.1155/2013/423403
35. Teh, J. K. L., Ng, S. T., Tey, N. P., & Siti Norlasiah, I. (2013). Ethnicity and Support for Parents in Malaysia. *Asian Women*, 29(4), 51- 72.
36. Teh, J. K. L., Tey, N. P., & Ng, S. T. (2014). Ethnic and Gender Differentials in Non-Communicable Diseases and Self-Rated Health in Malaysia. *PLoS ONE*, 9(3), e91328. doi: 10.1371/journal.pone.0091328
37. Lai, S. L., & Tey, N. P. (2014). Socio-economic and Proximate Determinants of Fertility in the Philippines. *World Applied Science Journal*, 31(10), 1828-1836. doi: 10.5829/idosi.wasj.2014.31.10.591
38. Tey, N. P. (2014). Inter-state Migration and Socio-demographic Changes in Malaysia. *Malaysian Journal of Economic Studies*, 51(1), 121-139.
39. Tey, N. P. (2014). International Perspectives of Contemporary Migration, Urbanization and Development in Asia Pacific and Across the Pacific. *Malaysian Journal of Economic Studies*, 51(1), 1-8.
40. Nagaraj, S., Goh, K. L., Cheong, K. C., Tey, N. P., & Jani, R. (2014). Gender Imbalance in Educational Attainment and Labour Market Dynamics: Evidence from Malaysia. *Malaysian Journal of Economic Studies*, 51(special issue), 127-146.
41. Teh, J. K. L., Tey, N. P., & Ng, S. T. (2014). Family Support and Loneliness among Older Persons in Multi-ethnic Malaysia. *The Scientific World Journal*, 2014(Article ID 654382), 1-11. doi: 10.1155/2014/654382

42. Ngoo, Y. T., Tey, N. P., & Tan, E. C. (2015). Determinants of Life Satisfaction in Asia. *Social Indicators Research*, 124(1), 141-156.
43. Tey, N. P., Ninti Siraj, S., Kamaruzzaman, S. B. B., Chin, A., Tan, M. P., Sinnappan, G. S., & Muller, A. M. (2016). Population Ageing in Multi-ethnic Malaysia. *The Gerontologist*, 56(4), 603-609. doi: 10.1093/geront/gnv153
44. Teh, J. K. L., & Tey, N. P. (2015). Trends in chronic diseases among the oldest old in China. Paper presented at the AIP Conference.
45. Teh, J. K. L., & Tey, N. P. (2016). Changes in loneliness among the oldest-old Chinese. Paper presented at the AIP Conference.
46. Nagaraj, S., Lee, K. H., Goh, K. L., & Tey, N. P. (2016). Malaysian Adolescents Not in School: The Nexus of Education, Work and Gender. *Malaysian Journal of Economic Studies*, 53(1), 87-113.
47. Tey, N. P., Lai, S. L., & Teh, J. K. L. (2016). The debilitating effects of chronic diseases among the oldest old in China. *Maturitas*, 94, 39-45.
48. Ng, S. T., Tey, N. P., & Asadullah, M. N. (2017). What matters for life satisfaction among the oldest old? Evidence from China. *PLoS ONE*, 12(2).
49. Yew, S. Y., Yong, C. C., Cheong, K. C., & Tey, N. P. (2017). Does Financial Education Matter? Financial Literacy among Undergraduates in Malaysia. *Institution and Economies*, 9(1).
50. Tang, C. F., & Tey, N. P. (2017). Low fertility in Malaysia: Can it be explained? *Journal of Population Research*.
51. Lai, S. L., Tey, N. P., & Ng, S. T. (2017). Socio-economic status and fertility among currently married women in 3 ASEAN countries. *Malaysian Journal of Economic Studies*.
52. Halimah Awang, Norma Mansor, Tey Nai Peng and Nik Ainoon Nik Osman. 2017. Understanding Ageing: Fear of Chronic Diseases Later in Life. *Journal of International Medical Research*. 0(0) 1-10/ Doi.10-1177-0300065-77-0857

Book Chapters

1. Abu Bakar, N. L., & Tey, N. P. (1983), '*Socio-economic Correlates of Mortality in Peninsular Malaysia*', in Ng, S. M. (ed.), "*Socio-economic Corrrleates of Mortality in Japan and ASEAN*", National Institute for Research Advancement and Institute of Southeast Asian Studies.
2. Tey, N. P. (1988), 'Migration, Job Mobility and Income Differentials in the Klang Valley, Malacca and Johor Bahru', in Tan, P. C. (ed.), *Proceedings of the Seminar on Current Issues in Labour Migration in Malaysia*, National Union of Plantation Workers and the Population Studies Unit, Faculty of Economics and Administration, University of Malaya.

3. Tey, N. P. (1991), 'Population Policy Formulation, Implementation and Evaluation: The Case of Malaysia' in Andorka, R., & Ursua, R. (eds.), *Proceedings of Conference on "The Utilisation of Demographic Knowledge in Policy Formulation and Planning*, International Union for the Scientific Study of Population.
4. Tey, N. P. (1991), 'Maternal Employment and Childcare, in "Securing Our Future', in Chiam, H. K. (ed.), *Proceedings of the Conference on Children - Our Future*, Child Development Centre and the Faculty of Medicine, University of Malaya.
5. Tey, N. P. (1992), 'Migration Decision-making and Family Linkages - A Case Study of the Klang Valley, Malacca and Johor Bahru', in Ariffin, J. (ed.), *Population Movements, Economic Development and Family Change*, Population Studies Unit, Faculty of Economics and Administration, University of Malaya.
6. Tey, N. P. (1994), 'Demographic Trends and Family Structure in Malaysia', in Chong, S., & Cho, K. S. (eds.), *Social Development Under Rapid Industrialization, The Case of Southeast Asia*, Institute of Strategic and International Studies (ISIS) Malaysia.
7. Tey, N. P. (1994), 'Sex Differentials in City-ward Migration and Occupational Mobility - A Study of Klang Valley', in Ariffin, J. (ed.), *Readings on Women and Development in Malaysia*, Population Studies Unit, Faculty of Economics and Administration, University of Malaya.
8. Tan, P. C., Tey, N. P., & Nagaraj, S. (1994), 'Sex Differentials and Mortality Trends in the Process of Development in Malaysia', in Ariffin, J. (ed.), *Readings on Women and Development in Malaysia*, Population Studies Unit, Faculty of Economics and Administration, University of Malaya.
9. Tey, N. P., & Liaw, S. H. (1995), "Patterns of Urbanization and Migration in Malaysia", in NPFDB, *Laporan Bengkel Maklumat Kependudukan: Ke Arah Perancangan Pembangunan Berkesan*.
10. Tey, N. P., & Tan, P. C. (1996). "The Changing Age Structure and Its Implications to the Malaysian Society", in Soon, L. Y., & Nagaraj, S. (eds.), *The Seventh Malaysia Plan: Productivity for Sustainable Development*, University of Malaya Press.
11. Chan, K. E., & Tey, N. P. (2000). 'Demographic Processes and Change' in Lee, K. H., & Tan, C. B. (eds.). *The Chinese in Malaysia*, Oxford University Press.
12. Tey, N. P. (2002), 'The Changing Demographic Situation of Malaysian Chinese', in Suryadinata, L. (ed.), *Ethnic Chinese in Singapore and Malaysia – A Dialogue between Tradition and Modernity*, Times Academic Press.
13. Tey, N. P. (2004), 'The Causes and Consequences of Demographic Changes of Chinese Malaysians', in Voon, P. K. (ed.), *The Chinese Population in Malaysia, Trends and Issues*", Centre for Malaysian Chinese Studies, Kuala Lumpur, (pp 15-48).
14. Yahaya, J., Tey, N. P., Yeoh, K. K., Nair, S., & Lee, H. A. (2004). 'Ethnic Relations Amongst University of Malaya Undergraduates', in Yahaya, J., Tey, N. P., & Yeoh, K. K. (eds.), *Interactions and Segregation on Campus and in the Workplace*, CEDER, University of Malaya.

15. Tey, N. P. (2005), 'Trends and Patterns of Urbanization in Malaysia, 1970-2000' in Ness, G. D., & Talwar, P. P. (eds.), *Asian Urbanization in the New Millennium*, Marshall Cavendish Academic (Auick Asian Urban Information Center of Kobe. Pp. 178-221).
16. Tan, P. C., & Tey, N. P. (2005), 'Empowering Older Adults as Key Resources in Development in Malaysia', in Yoon, H., & Hendricks, J. (eds.), *Handbook of Asian Aging*. Baywood Publishing Company. Inc. Amityville, New York.
17. Tey, N. P. (2005), 'Population and Development Trends', in Wong, Y. L., & Tey, N. P. (eds.), *Our People Our Future- Malaysian Population in Perspectives*, University of Malaya Press.
18. Tey, N. P., & Wong, Y. L. (2006). 'Introduction' in Wong, Y. L., & Tey, N. P. (eds.), *Our People Our Future- Malaysian Population in Perspectives*, University of Malaya Press.
19. Tey, N. P. (2006), 'Gender Differentials in Educational Attainment', in Nagaraj, S., Goh, K. L., & Tey, N. P. (eds.), *Statistics in Action*, University of Malaya Press.
20. Tey, N. P. (2007). 'The Family Planning Program in Malaysia' in Robinson, W. & Ross, J. (eds.), *The Global Family Planning Revolution, Three Decades of Population Policies and Programs*. The International Bank for Reconstruction and Development / The World Bank.
21. Tey, N. P. (2007). "The Demographic Trends and Human Capital of Malaysian Chinese", in Voon, P. K. (ed.) *The Roles of Malaysian Chinese in Nation Building*. Center for Malaysian Chinese Studies.
22. Ariffin, J., & Tey, N. P. (2008). "Malaysia" in *Social Services Policies and Family Wellbeing in the Asian and Pacific Region*, Asia Pacific Population and Social Studies, Series No. 165, UN ESCAP.
23. Tey, N. P. (2009). "The Changing Marriage Patterns among Women in Peninsular Malaysian Women Since 1970", in Arriffin, J. (Eds), *Women in Development- Two Decades of Change*, Chapter 12, MPH publisher.
24. Tey, N. P. (2009). Fertility Trends and Differentials in Peninsular Malaysia –Four Decades of Change in Arriffin, J. (eds). *Women in Development- Two Decades of Change*, Chapter 13, MPH publisher.
25. Tey, N. P., & Ng, S. T. (2009). "Malaysia" Chapter 30 in Palmore, E., Whittington, F., & Kundel, S. R. (eds). *International Handbook on Ageing: Current Research and Development*, Greenwood Publishing Group.
26. Tey, N. P. (2011). 'Understanding Marriage Trends and Patterns in Malaysia', Chapter 10 in Jones, G., Hull, T., & Mohamad, M. (eds). *Changing Marriage Trend in Insular Southeast Asia*, Routledge, Francis and Taylors Group.
27. Tey, N. P. (2012). "Socio-economic Characteristics of Older Malaysians", in Hamid, T. A., Sulaiman, H., & Abdullah, S. F. Z. (eds). *Profile of Older Malaysians: Current and Future Challenges*, Universiti Putra Malaysia Press, Serdang.

28. Ahmad, N., Tey, N. P., Kamarul Zaman, K. F., Muhd Sapri, N. A., Mohammed, M., & Yeoh, Y. K. (2012). "Status of Family Planning in Malaysia" in *Family Planning in Asia and the Pacific: Addressing the Challenges*, International Council on Management of Population Programmes, and UNFPA.
29. Tey, N. P., & Tengku Hamid, T. A. (2014). "Gender differentials in work and income among older Malaysians", in *Gender and Ageing – Southeast Asian Perspectives*, Edited by Devasahayam, T. W., Institute of Southeast Asian Studies, Singapore. Pages 229-267.
30. Nagaraj, S., Tey, N. P., Ng, C. W., Lee, K. H., & Pala, J. (2015). "Counting Ethnicity in Malaysia: The Complexity of Measuring Diversity" in *Social Statistics and Ethnic Diversity – Cross-National Perspectives in Classifications and Identity Politics*. (ed, Simon, P., Piche, V., & Gagnon, A. A.). Springer Open. IMISCOE.
31. Cheong, K. C., Tey, N. P., & Rasiah, R. (2016). "The Population Development Relationship in Malaysia" in Tey, N. P., Cheong, K. C., & Rasiah, R. (Eds). *Revisiting Malaysia's Population-Development Nexus*. University of Malaya Press. Kuala Lumpur, Malaysia.
32. Tey, N. P., Ng, S. T., & Tan, P. P. (2016). "Population Projection for Development Planning in Malaysia" in Tey, N. P., Cheong, K. C., & Rasiah, R. (Eds). *Revisiting Malaysia's Population-Development Nexus*. University of Malaya Press. Kuala Lumpur, Malaysia.
33. Tey, N. P. (2016). "Socio-economic Determinants of Fertility in Indonesia", in Ismail, N. A., Munisamy, S., & Osman, A. F. (eds). *Statistics in Research: 7-19*. Kuala Lumpur: University of Malaya Press. ISBN 978-983-100-847-8.
34. Tey, N. P. (2017). "Southeast Asia's Demographic Situation, Regional Variations and National Challenges", in *Southeast Asia Affairs 2017*, Institute of Southeast Asian Studies.
35. Tey Nai Peng (2017). "Population ageing in Malaysia, in Anthony Abeykoon, . Nora Murat, Gessen Rocas and Aurelio Camilo Naraval (ed). *Ageing Thailand, Malaysia, Indonesia and Cambodia: Demographic Transition, Policy and Programmatic Responses*. International Council on Management of Population Programmes (ICOMP).

Books Edited

1. Sine, J., Tey, N. P., & DaVanzo, J. (eds.) (1991). *Proceedings of the seminar on the Second Malaysian Family Life Survey*, Kuala Lumpur, Malaysia, October 1991. *RAND Conference Proceedings, Pub. Order No. CF-109-NICHD/NIA/WFH*. 1993. v, 170 pp. RAND: Santa Monica, California.
2. Yahaya, J., Tey, N. P., & Yeoh, K. K. (eds.) (2003). "*Sustaining Growth, Enhancing Distribution: The NEP and NDP Revisited*", CEDER, University of Malaya.
3. Yahaya, J., Tey, N. P., & Yeoh, K. K. (eds.) (2004). *Ethnic Interactions and Segregation on Campus and in the Workplace*, CEDER, University of Malaya.

4. Nagaraj, S., Goh, K. L., & Tey, N. P. (eds.) (2006). *Statistics in Action*, University of Malaya Press.
5. Wong, Y. L., & Tey, N. P. (eds.) (2006). *Our People Our Future, Malaysian Population in Perspective*. University of Malaya Press.
6. Tey, N. P., Cheong, K. C., & Rasiyah, R. (2016). *Revisiting Population and Development Nexus in Malaysia – the Past in Its Future*. University of Malaya Press.
7. Awang, H., & Tey, N. P. (ed.) (2017). *Who Says I Am Retired?* Social Security Research Centre, University of Malaya.
8. Tey, N. P. (ed.) (2017). *Population Situation Analysis - Malaysia*, Population Studies Unit, University of Malaya.

Scientific Reports/Occasional Papers/Monograph

1. Aziz, N. L., Tan, B. A., Mohd Nor, G., Hew, W. S., Khoo, S. K., & Tey, N. P. (1980). *Culture and Fertility - The Case of Malaysia*, Research Notes and Discussion Paper No. 19. Institute of Southeast Asian Studies.
2. Aziz, N. L., Tan, B. A., Mohd Nor, G., Hew, W. S., Khoo, S. K., & Tey, N. P. (1980). *Culture and Fertility - The Case of Malaysia*, Research Notes and Discussion Paper No. 19. Institute of Southeast Asian Studies.
3. Abu Bakar, N. L., Takeshita, Y., Tan, B. A., & Tey, N. P. (1983). *Intercensal Net Migration of Population in Peninsular Malaysia, 1970-80*, NFPB Research Paper No. 7, National Family Planning Board, Kuala Lumpur.
4. Tey, N. P., & Abdul Rahman, I. (1981). *Factors Affecting Contraceptive Use in Peninsular Malaysia, Voorburg, Netherlands, International Statistical Institute, World Fertility Survey*, Scientific Report No. 23, November 1981.
5. Abu Bakar, N. L., Tan, B. A., Tey, N. P., & Razak, R. (1985). *Ethnicity and Fertility in Malaysia*. Research Notes and Discussion Paper No. 52. Institute of Southeast Asian Studies.
6. Arshat, H., Takeshita, Y., Tan, B. A., & Tey, N. P. (1986). *Fertility Trends in Peninsular Malaysia: 1957-70 and 1970-80. Application of a decomposition technique*. Population Research Series, No. 1, 31 pp. National Population and Family Development Board: Kuala Lumpur, Malaysia.
7. Arshat, H., Tey, N. P., & Othman, R. (1987). *Malaysia - Case Studies in Population Policy*, United Nations, ST/ESA/SER.R/80, Department of International and Social Affairs, Population Policy Paper No. 14, New York.
8. Tey, N. P., Tan, B. A., Tan, P. C., & Kwok, K. K. (1988). *Direct and Indirect Determinants of Fertility in Malaysia*. A Report Submitted to the National Population and Family Development Board.

9. Arshat, H., Tan, B. A., Tey, N. P., & Subbiah. (1988). *Marriage and Family Formation in Peninsular Malaysia, An Analytic Report*. National Population and Family Development Board, Kuala Lumpur.
10. Tey, N. P. (1988). *Population Mobility and Development Issues: The Malaysian Experience*, National Population and Family Development Board, as part of the ASEAN-Australian Population Programme.
11. Tan, P. C., Chan, P. T. H., Tan, B. A., Tey, N. P., & Rajoo, R. (1988). *A study of Indian Women in the Estates in Peninsular Malaysia: Social Mixing, Marriage and the Family*. 129, [288] pp. University of Malaya, Faculty of Economics and Administration: Kuala Lumpur, Malaysia.
12. Tey, N. P. (1991). *Roles and Participation of Malaysian Women in Household Decision-making*, Faculty of Economics and Administration, University of Malaya and the National Population and Family Development Board.
13. Tey, N. P. (1991). *Utilization of Maternal and Child Health Services*, Faculty of Economics and Administration, University of Malaya and the National Population and Family Development Board.
14. Tey, N. P., & Tan, P. C. (1992). *Reports of Population and Family Surveys in Sabah and Sarawak* (National Population and Family Development Board, Malaysia).
15. Tan, P. C., & Tey, N. P. (1992). *Consequences of Population Change in Asia: The Malaysian Case*, ESCAP.
16. Cho, K. S., & Tey, N. P. (1992). *Family Care of the Elderly in Malaysia*. Institute of Strategic and International Studies and the National Population and Family Development Board, Malaysia.
17. Tey, N. P., & Awang, H. (1992). 'Some Implications of Rural-Urban Migration in the ESCAP Region', in ESCAP' in *Reports and Papers of the Expert Group Meeting on Trends, Patterns and Implications of Rural-urban Migration*, Bangkok, Thailand 306 November, 1992, UN, 1994, 25 pages.
18. Tan, P. C., & Tey, N. P. (1993). *Impact of Rural-urban migration on Rural Women and Family Life*, Faculty of Economics and Administration, University of Malaya.
19. DaVanzo, J., Haaga, J., Tey, N. P., Starbird, E., & Peterson, C. E. (1993). *The Second Malaysian Family Life Survey: Survey Instruments*. RAND and National Population and Family Development Board. ISBN 0-8330-1307-6.
20. Haaga, J., DaVanzo, J., Peterson, C., Tey, N. P., & Tan, B. A. (1994). *The Second Malaysian Family Life Survey: Overview and Technical Report*, Rand Corporation, Santa Monica, California, USA.
21. Tan, P. C., Lee, C., Tey, N. P., et. al. (1995). *ASEAN Social Indicators*, ASEAN Secretariat.

22. Tan, P. C., Ng, S. T., Embong, R., Tey, N. P., Mohd Yunus, J., & Chwee, G. L. (1996). *A Survey of the Middle Class in the Klang Valley, Malaysia*, A report prepared for the Southeast Asian Studies, Academia Sinica, Taiwan.
23. Tan, P. C., Tey, N. P., et. al. (1996). *Improving the Measurement of Women's Economic Activities*, FEA, UM.
24. Tey, N. P. (1996). "Demographic and Health Situation in Johore - A Gender Perspective" in Ariffin, J. (ed.), *Women and Development in Johor*.
25. Tey, N. P., Tan, P. C., et. al. (1997). *Contraceptive Use Dynamics in the Rural Areas of Peninsular Malaysia*. World Health Organization.
26. Tey, N. P., & Liaw, S. H. (1998). *Civil Society Resource Organizations and Development in Southeast Asia –the case of Malaysia*, Synergos Institute, USA.
27. Tan, P. C., Tey, N. P., et. al. (1998). *Women in the Informal Sector: Household Ethnography*, FEA, UM.
28. Tan, P. C., Ng, S. T., Tey, N. P., & Awang, H. (1999). *Evaluating Programme Needs Of Older Persons In Malaysia*, FEA Monograph Series No. 1, 1999.
29. Tan, P. C., Tey, N. P., et. al. (1999). *Measuring Family Economic Activities in the Informal Sector*, Faculty of Economics and Administration.
30. Tey, N. P. (2000). *Demographic Trends and Patterns in Kelantan*, in "Action Plans for Strategic Development for Kelantan", 1997-1999 (a report submitted to State Economic Planning Unit, Kelantan).
31. Tey, N. P., Othman, P., Tan, P. C., & Ng, S. T. (2000). *Rural Depopulation in Peninsular Malaysia*. Faculty of Economics and Administration, University of Malaya.
32. Yahaya, J., Goh, K. L., Yap, S. F., Tey, N. P., et. al. (2000). *Petronas Malaysian Grand Prix 2000-Economic Impact Study and Financial Analysis- A Report Submitted to Sepang International Circuit*.
33. Yahaya, J., Tey, N. P., & Liaw, S. H. (2001). *Chasing the Grades—Academic Performance of First Year FEA Students*, in Research Update, Vol. 1, No. 2, Jan, 2001.
34. Tey, N. P., & Ng, S. T. (2002). *Resource Handbook for Community Services*, Population Studies Unit, UM.
35. Tey, N. P. (2002). *Ethnic Relations Among FEA students*, FEA Research Update, 2002.
36. Kok, K. L., Tey, N. P., & Goh, K. L. (2003). *Survey on Financial Planning in Kuala Lumpur and Petaling Jaya*, a report submitted to Citibank.
37. Tey, N. P. (2003). *Assessing the Needs of Chinese Single Mothers in Malaysia – A Socio-economic Survey*, for Women Development Center, Malaysia.

38. Ang, E. S., Huang, M., & Tey, N. P. (2004). *ICPD Ten Years On: Country Monitoring and Advocacy of Sexual and Reproductive Health and Rights – Country Report of Malaysia*. Submitted to ARROW.
39. Tey, N. P., Yap, S. F., Lee, H. A., et. al. (2004). *Economic Impact Analysis of Petronas Malaysia Grand Prix*, a report submitted to the Ministry of Finance, through Macrowork Sdn. Bhd.
40. Tey, N. P. (2004). *e-RHAM for Youth Impact Study*, (A DAGS funded project), report submitted to DAGS through the Federation of Family Planning Associations, Malaysia.
41. National Population and Family Development Board, Malaysia (2005). *Assessing the Implementation of the ICPD-PoA in Malaysia*.
42. Tey, N. P. (2005). *Report of Baseline Survey of Family Life Educators and Peer Group Members*, submitted to Federation of Family Planning Associations Malaysia, under UNFPA funded project, on “Protecting Young Malaysians from HIV and STDs”.
43. Tey, N. P. (2005). *Report of Baseline Survey on the Knowledge, Attitude and Behavior Of Young People On HIV/AIDS and Reproductive Health*, submitted to Federation of Family Planning Associations Malaysia, under UNFPA funded project, on “Protecting Young Malaysians from HIV and STDs”.
44. Ng, S. T., Tey, N. P., Ismail, N. A., Jani, R., et. al. (2005). *Optimising the Potential of Older Persons As Critical Resource for Development - A Case Study in Urban Malaysia*, A Report for IRPA.
45. Awang, H., & Tey, N. P. (2006). *Analysis of Academic Human Resources at the University of Malaya*, report submitted to University of Malaya, under the Fundamental Research Funding.
46. Report on the Evaluation of the Impact of South-South Cooperation on Reproductive Health, a project under UNFPA-funded project on MAL/03/P04: South-South Cooperation in Reproductive Health in Malaysia”, 2007.
47. Report on Survey on the Knowledge and Behaviour Change of Young Malaysians on HIV/AIDS and Reproductive Health”, 2007.

Papers Presented at Conferences and Seminars since 1994

1. Tey, N. P., & Awang, H. (1992). Some Implications of Rural-Urban Migration in the ESCAP Region, Issues in the Study of Rural-Urban Migration: Report and Papers of the Expert Group Meeting on Trends, Patterns and Implications of Rural-Urban Migration, Bangkok, Thailand, 3-6 November 1992, United Nations, 1994, p. 25.)
2. Tey, N. P. (1994). *Some Demographic and Health Aspects of Malaysian Women*, paper presented at the Workshop on Malaysian Women within the Two Development Decades, 5-6 May, 1994, Kuala Lumpur.

3. Tey, N. P., & Tey, H. C. (1995). *The Elderly: An Untapped Resource*, paper presented at the Seminar on 'Ageing Population: National Policy Directions and the Role of Media', Asian Institute for Development Communication, Kuala Lumpur, 10 July.
4. Tey, N. P. (1996). *International Migration Research Using Popline Database*, presented at First International Meeting of Asia Pacific Migration Research Network, Bangkok, 10-13, March, 1996.
5. Nagaraj, S., & Tey, N. P. (1997). *Notes on Some Considerations Towards the Development of a National Social Index* paper presented at "Bengkel Indeks Sosial Negara, 5 July 1997, Ministry of National Unity and Social Development.
6. Nagaraj, S., Lee, K. H., & Tey, N. P. (1997). *Dimensions of Household Decision-making*, paper presented at Annual Meeting of the Population Association of America, 27-30 March, 1997.
7. Tey, N. P. (1997). *Social Equity: Policies and Programmes Affecting Older People in Malaysia*, paper presented at 22nd Federation of ASEAN Economic Associations Conference in Bali, 24-25 October 1997.
8. Tengku Aizan, & Tey, N. P. (1999). *Perlaksanaan Dasar Warga Tua Negara Ke Arah Pembangunan Masyarakat - kertas kerja dibentangkan di Persidangan "Penuaan Dalam Alaf Baru: Cabaran dan Peningkatan Peranan*, KWSP, KL, 30 September 1999.
9. Chan, K. E., & Tey, N. P. (2000). *Some Trends Affecting the Chinese Malaysian Population*, paper presented at Symposium on Malaysian Chinese, Selangor Chinese Assembly Hall, 15-16 April, 2000.
10. Tey, N. P., & Tan, P. C. (2000). *Population and Development Concerns*, paper presented at Malaysian NGO National Seminar on Reproductive Health, PJ, 20 April 2000.
11. Tey, N. P. (2001). *Implications of Demographic Changes on Family and Society*-paper presented at International Family Conference, Kuala Lumpur, Oct. 2001.
12. Tey, N. P. (2001). *Recent Demographic Trends of Chinese Malaysians*, paper presented at International Conference on Population and Chinese Community, January 2001, Kuala Lumpur.
13. Tey, N. P. (2001). *Integration of Population and Reproductive Health Issues into Environmental Development Program - the Case of Malaysia*, paper presented at International Workshop on Integration of Population and Reproductive Health into Environmental Development Program, 13-17 Bangkok, Thailand.
14. Tey, N. P. (2002). *Socio-economic and Ethnic Fertility Differentials in Peninsular Malaysia*, paper presented at IUSSP Regional Seminar on the Population of Southeast Asia in the Changing Asian Context, Bangkok, June 10-13, 2002 (available on website).

15. Tey, N. P. (2002). *Differential Response to Fertility Transition in Peninsular Malaysia*, paper presented at International Conference on “Fertility decline, below replacement fertility and the family in Asia: Prospects, consequences and Policies, 10-12, April, 2002.
16. Yahaya, J., &Tey, N. P. (2002). *Poverty and Income Inequality: Lessons from the Fishing Communities*, paper presented at “Seminar on Poverty Alleviation and Social Stability”, Malaysian Institute for Economic Research, 23 Oct. 2002.
17. Tey, N. P., Tan, P. C., Ng, S. T., et. al. (2002). *Age Friendly Primary Health Care – Malaysia Focus Group, report* presented at WHO Consultation on Age Friendly Primary Care, Perth, 26-27 Oct. 2002 and International Federation on Ageing - 6th Global Conference and EXPO, Perth, Australia.
18. Tey, N. P.(2002). Recommendations for Agenda 21 Implementation Based on Assessment of Malaysian Government Action on Demographic Dynamics and Sustainability”, presented to the NGO Forum on Agenda 21, Chapter 5.
19. Tey, N. P. (2003). *The Causes and Consequences of Demographic Changes of Chinese Malaysians*, paper presented at Seminar on Chinese Population in Malaysia, jointly organized by Centre for Malaysian Chinese Studies, Chong Hwa Old Boys Association and Soka Gakkai Malaysia, at Wisma Kebudayaan Soka Gakkai Malaysia, Kuala Lumpur, 3 August 2003.
20. Tey, N. P. (2003). *Exploiting the Power of SPSS for Survey Research and Data Analysis*, paper to be presented at the 9th Annual SPSS Conference 2003, 9th October 2003.
21. Tey, N. P.,& Ng, S. T. (2004). *Community Approach in Promoting ActiveAgeing*, paper presented at the International Seminar on Demographic Window and Healthy Aging: Socioeconomic Challenges and Opportunities, organized by the IUSSP Committee on Longevity and Health and the Asian Meta Centre in collaboration with Peking University, and the Center for Healthy Aging and Family Studies, Beijing, 10-11 May 2004.
22. Tey, N. P. (2004). *The Changing Trends and Patterns in Marriage Among Malaysian Women*, paper presented at the FEA Seminar, 7 September 2004.
23. Ng, S. T., &Tey, N. P. (2004). *To Retire or Not To Retire*, paper presented at National Conference on Population Ageing in the Developing World, Bridging Research, Policy and Practice. Institute of Gerontology, Department of Social Welfare, UNFPA and Gerontological Association of Malaysia, 5-6 October, 2004. The Summit Hotel, Subang USJ, Selangor.
24. Tey, N. P. (2004). *Prevalence of Delayed and Non-Marriage in Malaysia*, paper presented at the Asia Pacific Dialogue: Towards the Doha International Conference for the Family, organized by the National Population and Family Development Board, Malaysia and World Family Policy Centre, Kuala Lumpur, 11-13 October, 2004.

25. Tey, N. P. (2004). *Situation Analysis of Reproductive in ASEAN*, paper presented at Regional Technical Meeting on “Integrated Reproductive Health Services for Families, Women, Men and Adolescents”, National Population and Family Development Board, Ministry of Women, Family and Community Development, with United Nations Population Fund, 6-7 December, 2004.
26. Tey, N. P. (2005). *Utilization of Census and Major Survey Data for Analyzing Marriage Trends and Patterns in Malaysia*, paper presented at International Workshop on “Asian Marriage Research Network”, Asia Research Institute, National University of Singapore, 6-8 January, 2005.
27. Tey, N. P. (2005). *Government Commitment, Civil Society Initiatives and International/Regional Cooperation*, paper presented at National Dissemination Seminar on “ICPD Ten Years On – Country Monitoring Report of Malaysia, Malaysian National Coordinating Committee on Reproductive Health”, Summit Hotel, Subang Jaya, 13 August.
28. Tey, N. P. (2005). *Flight from Marriage Among Malaysian Men*. Paper Presented at FEA Seminar, 9 September, 2005.
29. Tey, N. P. (2005). *Making the Most Out of Census Data with SPSS*, paper presented at 11th Annual Conference, SPSS User Group, 28 September, Eastin Hotel, Petaling Jaya.
30. Tey, N. P. (2006). *Trends and Correlates of Delayed Marriage in Malaysia and Implications for Development*, paper presented at International Conference on Population and Development in Asia: Critical Issues for A Sustainable Future, 20-22, March, 2006, Phuket, Thailand.
31. Tey, N. P. (2006). *Interactions Among Family Members*, presented at International Family Scholar Colloquium, to be held in Kuala Lumpur, 7, August, 2006.
32. Tey, N. P., & Awang, H. (2006). *An Analysis of Academic Human Resource at the University of Malaya: Meeting New Challenges - Three Case Studies of Good Practice*, presented at 2nd Conference of Association of Commonwealth Universities (ACU) HRM Network on “Planning for the Future: University Human Resource Management in the Next Decade”.
33. Tey, N. P. (2006). *Marriage and Family Formation in Peninsular Malaysia*, paper presented at National Conference on Population and Development: Building the Next Generation, National Population and Family Development Board, Sunway Hotel, 5-7 August 2006.
34. Tey, N. P., & Ng, S. T. (2006). *Economic and Social Participation of Older Persons*, presented at National Conference on The Role of Older Persons in the 9th Malaysia Plan, USIAMAS, Hotel Singasanah, 18 September 2006.
35. Tey, N. P. (2006). *Internal Migration in Malaysia – The case of Kuala Lumpur and Selangor*, paper presented to the International Conference on “Emerging Population Issues I the Asia Pacific Region: Challenges fro the 21st Century”, Mumbai, 10-13 December, 2006.

36. Tey, N. P. (2006). *Ethnic Fertility Transition in Malaysia: Socio- economic nexus and differential response to state policy*, paper presented to the Seminar on “Fertility Transition in Asia: Opportunities and Challenges in Asia”, ESCAP, Bangkok, 18-20 December 2006.
37. Ng, S. T., & Tey, N. P. (2007). *Marriage, Gender Roles and Childbearing in Urban Malaysia: A Case Study of Kuala Lumpur and Petaling Jaya Metropolitan Areas*. Paper presented to International Workshop on Population Issues in East and Southeast Asian Countries, 28 February – 1 March 2007. Waseda University, Tokyo.
38. Tey, N. P. (2007). *Causes and Consequences of Fertility Decline among Malaysian Chinese*, paper presented at International Conference on: Sino-Malaysian Relations and Ethnic Chinese in Malaysia, Institute of Malaysian Studies, Xiamen University and Institute of China Studies, University of Malaya and Xiamen University.
39. Tey, N. P. (2007). Fertility Trends and Differentials in Peninsular Malaysia, paper presented at International Conference on Understanding Health and Population Over Time: Strengthening Capacity in Longitudinal Data Collection and Analysis in Asia and the Pacific Region, Mahidol University, Bangkok.
40. Tey, N. P. (2007). Population Growth and Social Change in Malaysia. Paper presented at the National Population Conference on Demographic Windows for Development: Opportunities and Challenges, National Population and Family Development Board.
41. Tey, N. P. (2007). Pertumbuhan, Taburan dan Mobiliti Penduduk Malaysia. Kertas dibentangkan pada Majlis Pelancaran Handy Pop dan Seminar Kependudukan Sempena Hari Penduduk Sedunia, Negeri Sembilan.
42. Tey, N. P. (2007). Singlehood and Widowhood in Malaysia, paper presented to Workshop for Marriage Research Project, Ford Foundation funded project, National University of Singapore.
43. Tey, N. P. (2007). Perancang Keluarga dan Kesihatan Reproduktif, kertas kerja dibentangkan pada Persidangan Penduduk dan Pembangunan Sarawak: Membina Generasi Hadapan, Kuching, Sarawak.
44. Tey, N. P. (2007). Sharing Experience of Consultancy, paper presented at IPPF International Workshop on “Managing Professional AIDS Consulting Business, Kuala Lumpur.
45. Tey, N. P., & Awang, H. (2008). “Ciri-ciri Sosio-ekonomi Warga Mas Malaysia”, paper presented at Bengkel wanita, persaraan dan penuaan : Polisi rancangan dan program, KPWKM, Yayasan Pendidikan & Vokasional wanita Malaysia, Wonderful Freedom sdn Bhd., Singhsana Hotel, 17, April.
46. Arrifin, J., & Tey, N. P. (2008). ‘Social Services and Protection for Malaysian Family in the Context of Socio-demographic Change’ paper presented at Regional seminar on Enhancing social services policies to strengthen family well-being in Asia and the Pacific, UNESCAP, Macau, 13-15 May.

47. Nagaraj, S., Tey, N. P., Ng, C. W., & Balakhrisnan, B. (2008). 'Gender and Ethnic Dimensions of Changes in the Leading Causes of Death in Malaysia, 1970-2004', paper presented at Australian Population Association 14th Biennial Conference, Alice Springs, 30 June- 3 July.
48. Mansor, N., Tey, N. P., & Devason, E. S. (2008). 'Youth Development – Policies and Programs', paper presented at Persidangan Kependudukan Kebangsaan 2008, "Youth and the Chaning Demographics" Matrade, National Population and Family Development Board, August 18-19.
49. Tey, N. P. (2008). 'Education, Work, Marriage and Wellbeing in Malaysia', paper presented at Conference on Marriage, Culture and Poverty in Southeast Asia, The Graduate School, Gadjah Mada University, Yogyakarta, Indonesia, 21-22 August.
50. Tey, N. P. (2008). "Marriage, Marital Dissolution and Remarriage in Malaysia", paper presented at Workshop on Changing Marriage in Southeast Asia, National University of Singapore, 10 December, 2008.
51. Tey, N. P. (2008). 'Contraceptive Use and Unmet Need for Contraception in Peninsular Malaysia' paper presented at FFPAM—RRAAM Consultation Increasing Access to the Reproductive Right to Contraceptive Information and Services; Monitoring Progress since the 1994 ICPD Agreements, Shah Motel, Petaling Jaya, 21st, October.
52. Tey, N. P. (2008). 'Employment and Income of Older Malaysians', paper presented at National Conference on Ageing 2008: Promoting Dignity, Prosperity and Wellness. Institute of Gerontology, UPM, Ministry of Health and United Nations Population Fund Malaysia, Pan Pacific Hotel, KLIA, 4th November.
53. Tey, N. P. (2008). 'Demographic Changes in Malaysia' paper presented at Global and Economic Policy (GEP) Workshop on Health, Population and Economic Development, Nottingham University, Chulan Tower, Kuala Lumpur. November 14.
54. Tey, N. P. (2009). 'Economic Status of Older Men and Women in Malaysia', paper presented at Gender and Ageing in Southeast Asia: Contexts, Concern and Contradictions. Institute of Southeast Asian Studies, Singapore, 10-11, February.
55. Tey, N. P., & Yew, S. Y. (2009). "Impact of Global Crisis on the Malaysian Economy and Its People", paper presented at CPDS Workshop on the Global Crisis and Its Impact on Poverty, University of Malaya, 29 July, 2009.
56. Tey, N. P. (2009). "Income and Expenditure of Staff of Local Authorities in Johore", paper presented at Workshop on CPDS Research Output, University of Malaya, 13-14 July, 2009.
57. Tey, N. P. (2009). Regional and Urban-rural Differentials in Employment Growth in the 1990s", paper presented at Workshop on CPDS Research Output, University of Malaya, 13-14 July, 2009.
58. Balakrishnan, B., Tey, N. P., Nagaraj, S., & Marican, S. (2009). The intention of migrant workers to stay in Malaysia: A case study of semi-skilled Indonesian migrant workers in Malaysia," paper presented at the ICONSEA (Kuala Lumpur, 2009).

59. Tey, N. P., & Abdul Rahman, A. (2009). "Fertility Decline despite Stagnation of Contraceptive Prevalence Rate in Malaysia", presented at 5th Asia Pacific Conference on Reproductive and Sexual Health Rights, Beijing, China, 18-20, October, 2009.
60. Tey, N. P. (2010). "Gender and Family Issues", presented at Forum Konsultatif Kajian Pelan Strategik Kependudukan Ke-2, Siri 3, LPPKN, KL. 10 March.
61. Tey, N. P. (2010). "Current Status and Issues of Reproductive Health in Malaysia", presented at Forum Konsultatif Kajian Pelan Strategik Kependudukan Ke-2, Siri 2. LPPKN, KL. 18 February.
62. Tey, N. P. (2010). "Declining Fertility, Delayed Marriage, Stagnation of Contraceptive Use and Increasing Abortion in Malaysia", 12, March, 2010, Seminar Jabatan Statistik Gunaan, FEP, UM
63. Lai, C. U. R., & Tey, N. P. (2010). "Indonesian Domestic Workers in Malaysia: Opportunities and Risks", paper presented at 9th ASEAN Inter-University Seminar, Aceh, Indonesia, 25 May, 2010.
64. Tey, N. P., & Gu, B. C. (2010). "Fertility Transition in China and Malaysian Chinese Community", paper presented at International Conference on China in Transition: Economic Reform and Social Change, 21-22 July Institute of China Studies, University of Malaya, Petaling Jaya, Malaysia
65. Jani, R., Tey, N. P., & Singaravelloo, K. (2010). "Analisis Trend Pengajian Tinggi", dibentangkan pada Pembentangan Hasil Kajian Di Mesyuarat Khas Bersama Menteri Pengajian Tinggi, di Kementerian Pengajian Tinggi, 30 September, 2010.
66. Tey, N. P., Hosseini, H., & Ng, Y. M. (2010). "The Roles of Men in Family Planning in Indonesia", paper presented at the First International Conference, Asian Population Association, New Delhi, November 2010.
67. Tey, N. P., & Yew, S. Y. (2010). "Research on Step and Blended Families in Malaysia", presented at International Conference on Divorce, Re-marriage, Step Families & Blended Families: Challenges and the Way Forward, 1-3 November 2010, Crowne Plaza Mutiara Kuala Lumpur, organized by Asia Pacific Forum on Families, National Population and Family Development Board, Family Development Foundation of Johor and La Trobe University.
68. Ahmad, N., Tey, N. P., Kamarul Zaman, K. F., Muhd Sapri, N. A., Abdul Manaf, M., & Yeoh, Y. K. (2010). "Status of Family Planning in Malaysia, 2010". In UNFPA and ICOMP Asia and The Pacific Regional Consultation Family Planning in Asia and The Pacific - Addressing the Challenges December 8-10, 2010 Royal Hotel Orchid Sheraton Hotel and Towers Bangkok, Thailand.
69. Tey, N. P. (2010). "Reproductive Health and Family Planning", presented at Bengkel Pelan Tindakan Kependudukan dan Pembangunan, Siri 1, Kajian Pelan Strategik Kependudukan Ke-2, 23-24 Disember 2010, Kuala Lumpur, National Population and Family Development Board.

70. Awang, H., Singaravelloo, K., &Tey, N. P. (2010). "Fostering Ethnic Interaction among Secondary School Students". In 6th International Conference on Teacher Education, 2010, Celebrating Diversity and Transformative Innovations in Teacher Education, 29 to 30 July 2010, Quezon City, Philippines.
71. Tey, N. P. (2011). "Fertility Trends and Policies in Asia". In International Conferences on Population Dynamism in Asia: Issues and Challenges, University of Malaya, Kuala Lumpur, 11-13 July 2011
72. Tey, N. P. (2011). "Reproductive Health: Fertility, Contraceptive Use and Induced Abortion". In International Conferences on Population Dynamism in Asia: Issues and Challenges, University of Malaya, Kuala Lumpur, 11-13 July 2011
73. Tey, N. P., & Lai, S. L. (2012). "Malaysian Chinese in the New Millennium" In International Conference on Socio-economic Development, Ethnicity and Social Cohesion: China and Malaysia in Perspective, jointly organized by Institute of China Study, University of Malaya and Faculty of Political Science, Qinghai Nationalities University, 25-26 April, 2012, at UM.
74. Abdul Rahman, A., &Tey, N. P. (2012). "Policy Responses to Demographic Changes - the Case of Malaysia". In Asia Population Association Second International Conference, 26-29 August, 2012, Bangkok.
75. Tey, N. P. (2012). "Consistency of educational attainment in explaining unmet need for contraception and excess fertility in three ASEAN countries". In Asia Population Association Second International Conference, 26-29 August, 2012, Bangkok
76. Tey, N. P. (2012). "Spousal age and educational differentials in three ASEAN Countries" In International Conference on Marriage in Asia: Trends, Determinants & Implications, 15-16 November 2012, Singapore.
77. Tey, N. P. (2013). "Internal migration and socio-demographic changes in Malaysia". In International Population Conference on Migration, Urbanisation & Development, 8 July 2013, Faculty of Economics and Administration, University of Malaya, Kuala Lumpur.
78. Tey, N. P. (2013). "Family planning programmes and the reduction in fertility in South and Southeast Asia". In XXVII International Population Conference, International Union for the Scientific Studies of Population, Busan, Korea, 26-31 August 2013
79. Lai, S. L., &Tey, N. P. (2013). "Explaining the current fertility differentials in three ASEAN countries". In XXVII International Population Conference, International Union for the Scientific Studies of Population, Busan, Korea, 26-31 August 2013
80. Tey, N. P. (2013). "Demographic transition amidst socio-economic and policy changes in China". In International Conference "From Hu-Wen to Xi-Li Administration: China Leadership Transition and Its Domestic and International Implications". Institute of China Studies (UM), East Asian Institute (Singapore), UM, 12-13, September, 2013

81. Tey, N. P. (2013). "Trends and differentials in age at menarche among Filipino girls". In International Research Symposium on Population Health, Faculty of Medicine, University of Malaya, 19-20 November, 2013.
82. Ng, S. T., & Tey, N. P. (2013). "Identification of Things and Images Associated with Islam and Muslim among UM Students", paper presented at International Seminar on Islam and Multiculturalism: Coexistence and Symbiosis, Waseda University, Tokyo, 20-21 December 2013.
83. Tey, N. P., & Norlasiah, S. (2014). "Understanding the Reasons Behind the Stalling in Contraceptive Use: Towards Revitalizing Family Planning in Malaysia", paper presented at 7th Asia Pacific Conference on Reproductive and Sexual Health and Rights (APCRSHR) January 21-24, 2014, Manila.
84. Tey, N. P. (2014). "Trends and Patterns in Adolescent Fertility and Contraceptive Use in Southeast Asia: Governments' Responses" poster presented at 7th Asia Pacific Conference on Reproductive and Sexual Health and Rights (APCRSHR) January 21-24, 2014, Manila.
85. Tey, N. P. (2014). "Demographic Transition in Multi-ethnic Malaysia", paper presented at International Conference on Demographic Transition, Transformations of Kinship and Marriage, and the Application of Islamic Family Law, Fribourg, Switzerland, 15-17 May, 2014.
86. Tey, N. P., Ng, S. T., & Tan, P. P. (2014). "Population Projection for Development Planning in Malaysia". Paper presented at National Population Conference on the Inter-relationships between Population Dynamics and Development, Putrajaya, 26, June 2014.
87. Tey, N. P., & Huang, M. (2014). "Universal Access to Sexual and Reproductive Health and Rights – Survey on ICPD Beyond 2014, Malaysia", paper presented at Policy Dialogue on Universal Access to Sexual and Reproductive Health and Rights towards the ICPD Review and Post-2015 Development Agenda, FHRAM, 3.9.2014.
88. Tey, N. P. (2014). "Family Care and Support for Older Malaysians", Paper presented at International Conference on Healthy Ageing 2014- Bridging Science and Healthcare 20-21 October 2014, International Medical University Bukit Jalil, Kuala Lumpur, Malaysia.
89. Tey, N. P. (2014). "Ethnic Trends and Differentials toward Replacement Fertility in Malaysia, paper presented at Conference on Exploring and Revisiting Issues in Malaysian, Chinese Research 2014, New Era University, 8-9 November 2014
90. Tey, N. P. (2014). "Socio-demographic Changes in Malaysia Since 1960". Paper presented at International Statistical Institute (ISI) Regional Statistics Conference, Kuala Lumpur, 16-19 November 2014
91. Tey, N. P. (2014). "Population Ageing amidst Socio-demographic Changes in Malaysia". Paper presented at The Second International Conference on Social Security 2014 "Social Dimensions of Economic Development and Productivity: Lessons, Challenges and Opportunities for Southeast Asia, 3-5 December 2014, Hilton Hotel, Petaling Jaya.

92. Ng, S. T., Tey, N. P., Sia, B. K., Okai, H., & Tanada, H. (2014). "Push and Pull Factors Issues and Problems faced by International Muslim Students of University of Malaya". Paper presented at INTERNATIONAL CONFERENCE ON ISLAM AND MULTICULTURALISM: Exploring Islamic Studies within a Symbiotic Framework, jointly hosted by AEI (UM) and Waseda University, Japan, December 13, 2014.
93. Tey, N. P., & Sia, B. K. (2015). "The Recent Rise in Chronic Disease Prevalence among the Oldest Old in China", paper presented at Third International Conference of Asian Population Association (APA), 27-30 July 2015, Kuala Lumpur.
94. Tey, N. P. (2015). "Intergenerational Persistence of Spousal Violence in Three Asian Countries". Paper presented at Third International Conference of Asian Population Association (APA), 27-30 July 2015, Kuala Lumpur.
95. Ng, S. T., & Tey, N. P. (2015). "Activities of Daily Life, Leisure Activities and Life Satisfaction of Residents in Old Folks Homes", Paper presented at Third International Conference of Asian Population Association (APA), 27-30 July 2015, Kuala Lumpur.
96. Lai, S. L., & Tey, N. P. (2015). "Violence against Women - The Case of the Philippines", Paper presented at Third International Conference of Asian Population Association (APA), 27-30 July 2015, Kuala Lumpur.
97. Tey, N. P. (2015). The Roles of Government and Community in Promoting Elderly Wellbeing in Malaysia. International Association of Gerontology and Geriatric Congress, 19-22 October, 2015, Chiangmai, Thailand.
98. Goh, K. L., & Tey, N. P. (2016). Gender and education: the case of high male dropout rate, paper presented at The Joint World Conference on Social Work, Education and Social Development 2016, June 27-30, COEX, Seoul, Korea.
99. Lai, S. L., & Tey, N. P. (2016). Factors affecting women's empowerment in Cambodia, paper presented at The Joint World Conference on Social Work, Education and Social Development 2016, June 27-30, COEX, Seoul, Korea.
100. Tey, N. P. (2016). Multiple Classification Analysis of the Determinants of Income, paper presented at Advanced Analytics & SPSS Users' Association of Kuala Lumpur & Selangor – 20th User Conference @ The Aloft KL Sentral – 6th December 2016.
101. Tey Nai Peng and Lai Siow Li (2017). The Demographic Trends of Chinese Malaysians. Paper presented at Seminar on Trends and Challenges of Chinese Malaysian Population, University Tunku Abdul Rahman (UTAR), Sungai Long, Selangor, 21 April, 2017.
102. Tey Nai Peng (2017). Ultra-low Fertility of Chinese Communities in Malaysia. Forum on Malaysian Chinese Population: Mapping Changing Social and Demographic Trends, 10 June, 2017, Office of Academic Affairs, New Era University College.
103. Tey Nai Peng (2017). Demographic Transition and Development in Malaysia. Paper presented at Population and Development of Countries and Regions along the Belt and Road – Shanghai Forum 2017, Shanghai International Convention Center, Shanghai, China, 27-29 May 2017.